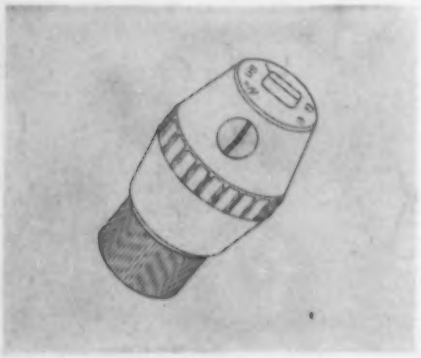
MODERN PLASTICS

APRIL 1944

DESIGN DATA ON PLASTICS

IV. An Interesting Case History FROM THE DUREZ LABORATORIES

There are few designs accomplished with Durez phenolics of more technical interest than the grenade and fuse described here. And there is no molded piece in which we are more proud to have had a part than this "exploder of the Nazi myth."



The designers' prayers for a versatile material were answered

This seven-molded-part grenade and fuse called for some real designing ingenuity. And surely the designers' prayers for a versatile material were answered with the two Durez phenolics used.

The designers had to provide for fast production. Grenades are needed in enormous numbers. The moldability of Durez is a "spark plug" to speedy production. Two methods of molding were used . . . a reminder of the many advances which have been made in the faster molding of phenolics.

The designers had a worry (with a capital W) on their hands when it came to tolerances. There had to be molded-in threads, internal and external, and some very exact fits were obviously needed. Durez was the answer, with its moldability to extremely close measurements.

The designers were also up against severe service requirements. Grenades must work under all conceivable climatic conditions. Specifications were set up for a material with dimensional stability between −40° F and +170° F, and impervious to all kinds of weather. Furthermore, the material must not affect the explosive with which it is in contact. You know why!

These properties were all imparted to the same Durez phenolics which provided the desired moldability.

The designers were up against severe service requirements

All in all, this piece of "bad news for the super-race" gives you an idea of what can be accomplished when designer, material manufacturer and custom molder pool their talents. We welcome your inquiry on all plastic material problems and offer the facilities of one of the Plastics Industry's most experienced technical staffs in helping you work them out. Durez Plastics & Chemicals Inc., 54 Walck Road, North Tonawanda, N. Y.

DUREZ

PHENOLIC MOLDING COMPOUNDS AND RESINS

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Exquisite toiletry containers designed of nature-rich colors are as intimately entrancing as they are desirably practical.
Catalin's highly developed casting techniques and Loalin's superior molding qualities beckon to the designer, confident that by their use his talents will find faithful interpretation.
Catalin's engineering staffs are readied to cooperate. Their counsel and help are available to those who are planning now. Inquiries invited.
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ARE YOUR PLASTICS "Morning Glories"

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Sure you can sell all the plastics you can make right now. But how about tomorrow? How about the long years after the war, when demand drops to normal, and competition gets tough? ★ Now is the time to get your feet on the ground . . . to get the true low-down on your plastics . . . to get the truth, even if it hurts! ★ The United States Testing Company, Inc., is prepared to test your plastics from every viewpoint of serviceability . . . and to test them for application to any type of use. Armed with these facts, you can adapt your plastics to the demands of tomorrow . . . assure their place in postwar markets. ★ Submit your plastics to scientific test immediately. Write for price list of routine tests.

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"Facts About Plastics" is a new, illustrated, non-technical booklet containing information about plastics. A copy should be in the possession of every executive considering the use of plastics. A request on company letterhead is all that is necessary.

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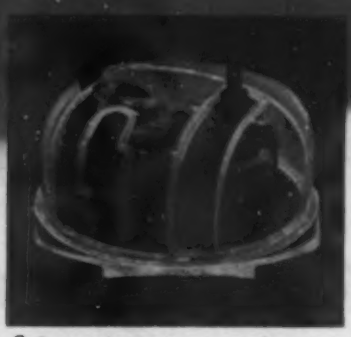
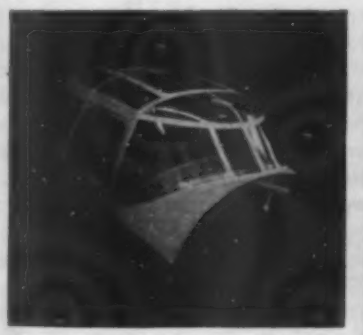
How North American uses "LUCITE"

Applications of Du Pont "Lucite" Methyl Methacrylate Resin Sheets in the Mitchell B-25

1. Tail cone of "Lucite" enables an observer to look back and check the result of a bomb run over the target. Latest B-25 carries a machine gun at this tail position.



2. To give the turret gunner a clear view overhead and to each side, North American provides another enclosure of Du Pont "Lucite" here. Notice how few reinforcing ribs are needed for rigidity.



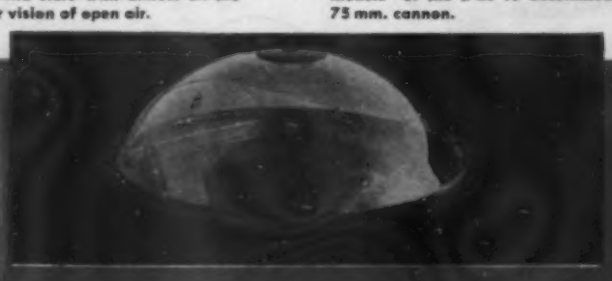
3. Pilot's enclosure in North American's Mitchell medium bomber is another multi-section structure in which all transparent portions except the windshield are "Lucite."

4. Twenty sections of "Lucite" are used in the bombardier's "greenhouse." At the upper left will be the escape hatch, not built integral with the enclosure. This enclosure has been changed on new "attack models" of the B-25 to accommodate a 75 mm. cannon.

5. The astro-dome of "Lucite" in the B-25 lets the navigator shoot the sun and stars with almost all the clear vision of open air.

LIKE so many other plane builders, North American uses Du Pont "Lucite" methyl methacrylate resin sheets for enclosures in the Mitchell B-25 on the basis of several distinct advantages. First of these is the *transparency* of "Lucite"; in colorless sheeting as used in aircraft, "Lucite," even in thicknesses of several inches, absorbs less than 1% of visible light. This feature—plus remarkable sunlight and weather resistance, lightness, tensile and impact strength, satisfactory resistance to chemicals to which it is commonly exposed, and other properties—commends the use of "Lucite" in many aircraft applications.

A reprint edition of the helpful 114-page aircraft manual on "Lucite" is now on the presses. This manual gives detailed information on fabricating, forming, repairing, and general properties. If you'd like a free copy, write on your business letterhead. We'll be glad to reserve a copy in your name, and send it as soon as it's ready. Address E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J., or 5801 So. Broadway, Los Angeles 3, Cal. In Canada: Canadian Industries, Ltd., Box 10, Montreal.



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Ready for the things to come —

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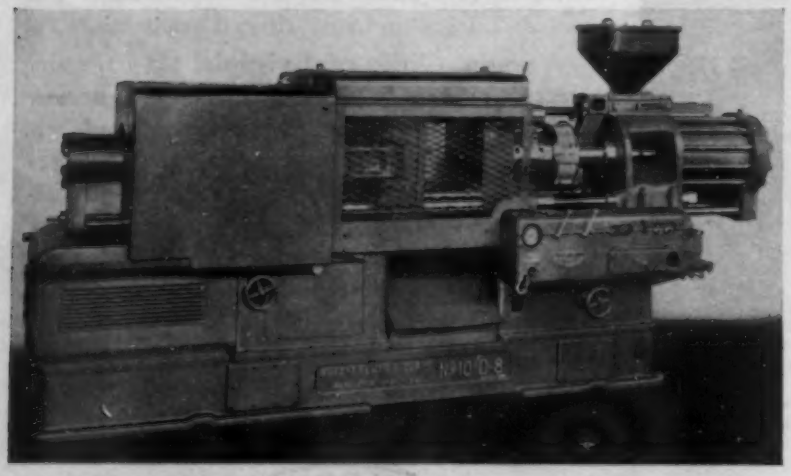

SPECIFICATIONS

Size of die plates	30" x 30"
Clearance between top and bottom frame members	29"
Maximum die height	20"
Minimum die height	8"
Weight, tons	14½
Motor required, 1200 RPM	40 H. P.

Send for Circular 10F — 22

REED-PRENTICE Injection Molding Machines are also available in 10A — 4 oz., 10D — 6 oz., and 10D — 8 oz. sizes.
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The technical service division of Celanese Celluloid Corporation has accumulated facts and data of interest to aviation manufacturers and designers. You are invited to make use of this information in both your short and long-range planning. Celanese Celluloid Corporation, *The First Name in Plastics*, a division of Celanese Corporation of America, 180 Madison Avenue, New York City 16. *Representatives:* Dayton, Philadelphia, Cleveland, Chicago, St. Louis, Detroit, Los Angeles, Washington, D. C., Leominster, Montreal, Toronto.

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plastics production job . . .
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our research,
development,
and die dept's. . . .
and more
heavy section
injection-molding machines
than
all other producers
put together . . .
may be
the aspirin you need.

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PROLON PLASTICS

For Outstanding Performance

in the Production of War Materials

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for Aircraft

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AUBURN, "The Cordage City," N. Y.
Makers of Co-Ro-Lite Plastics

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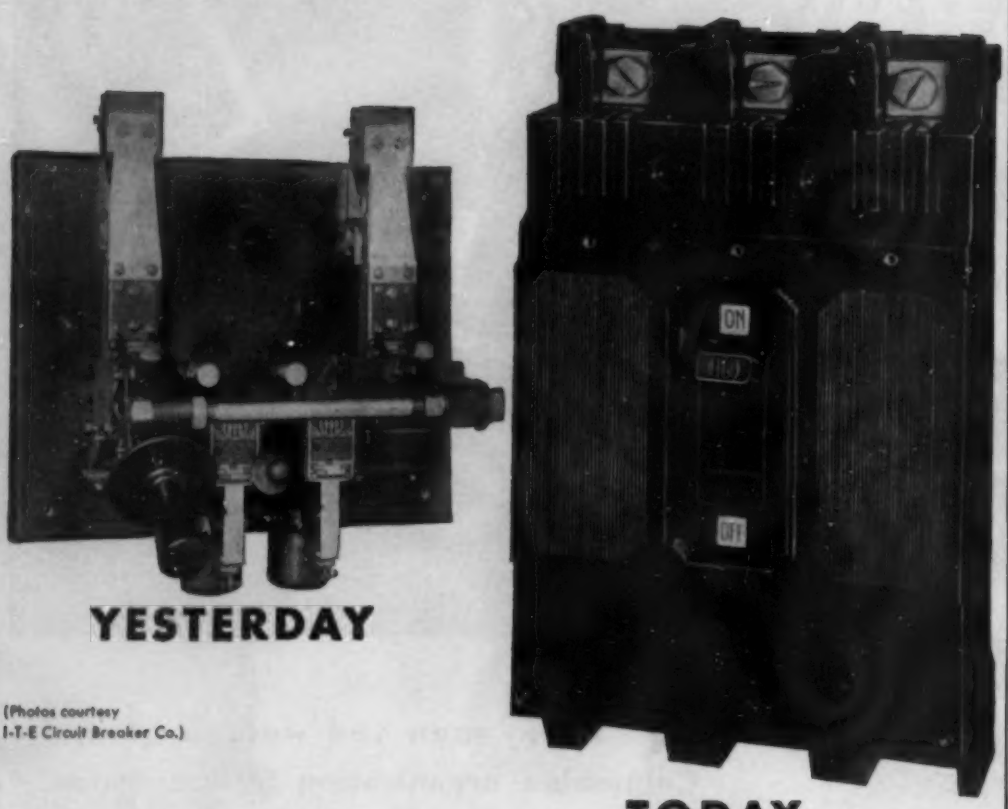
WOULD YOU GO BACK?



YESTERDAY

TODAY

(Photos courtesy
I-T-E Circuit Breaker Co.)

Tomorrow!

The design engineer of 1911 worked wonders with the limited materials at his disposal . . . yet few of us would want to go back to 1911 models. C-D DILECTO, a laminated phenolic plastic, was first made in 1911, when it was introduced as a "waterproof" type of vulcanized fibre. Today C-D DILECTO is available in many different grades . . . each engineered to meet specific electrical insulating problems.

C-D Laboratory Research is continuous and tomorrow will be producing new electrical insulating materials to meet the ever more exacting demands of electrical engineers. If experimental work will assist you in your post-war plans . . . write us today.

W-44

DILECTO

laminated phenolic electrical insulation

NEMA standards exist for the regular grades of laminated phenolics. These standards provide sufficient design data for the normal electrical insulating requirement. Where special problems are encountered, such as excessive moisture, high or low temperatures, U-H-F, arc tracking; the C-D Laboratory Staff of trained technicians will study your problem and if necessary develop a special grade of DILECTO to meet it.

Through special manufacturing methods, and Laboratory control, the properties of regular grades of DILECTO can be changed to meet special problems. For example, the C-D specifications for special DILECTO XPLW require the following properties as compared to NEMA standards for XXXP—both "low loss" grades of DILECTO.

	⅛" THICKNESS	
	C-D Control Standards	NEMA Standards
Tensile Strength lbs. per sq. in. . . .	10,000	5,000
Flexural Strength lbs. per sq. in. . . .	20,000	12,000
Compressive Strength lbs. per sq. in. . . .	30,000	25,000
Water Absorption, 24 hrs., percent .	.75	.85
Dielectric Str., Short Time, volts per mil	600	360
Power Factor— 1000 Kc	.026	.030
Dielectric Constant .	4.00	5.20

DILECTO catalog DO 43 gives complete data on regular and special grades, provides design suggestions, and information on standard sizes of sheets, rods and tubes. Send for your copy today.

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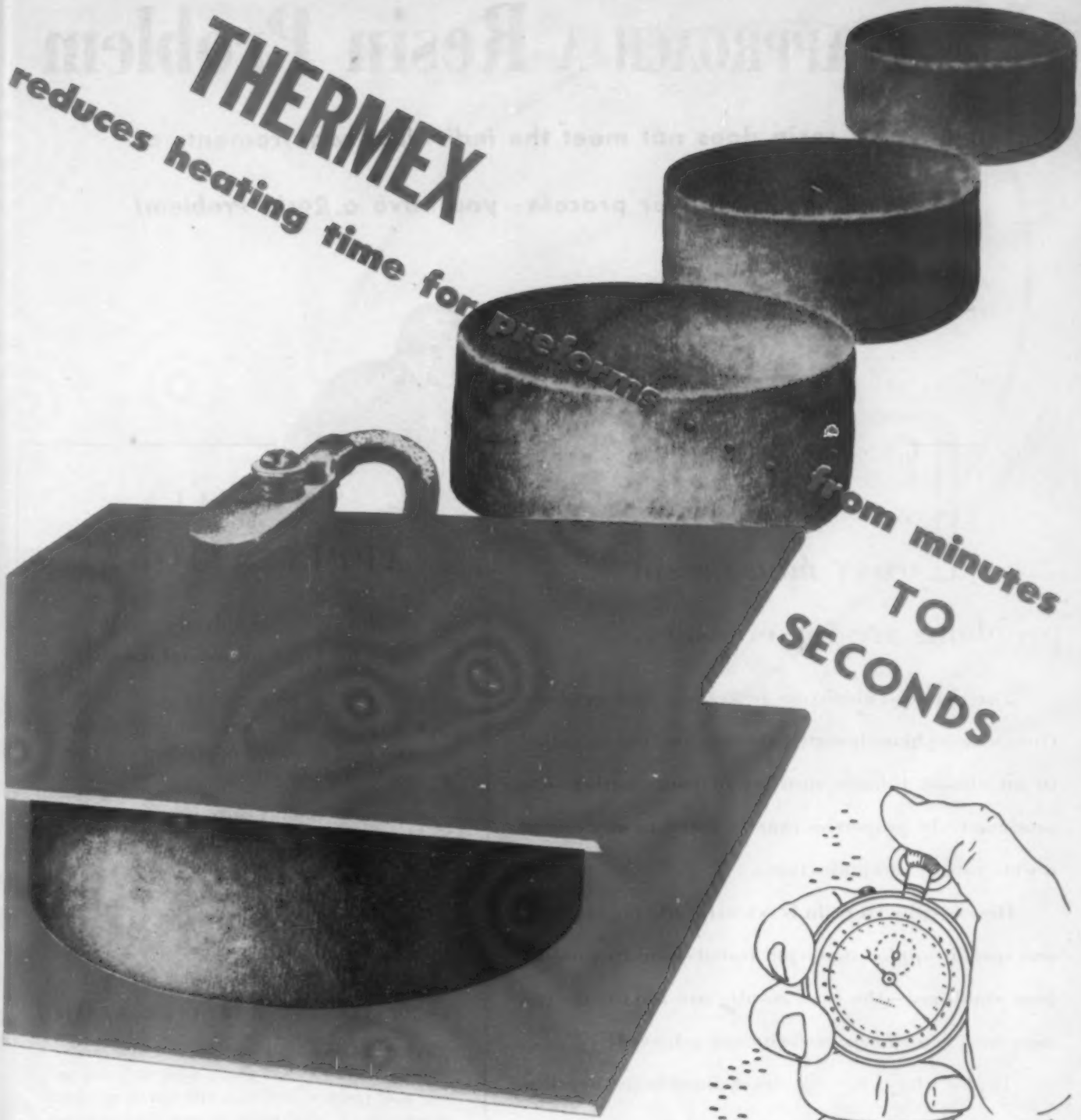
reduces heating time for preforms from minutes TO SECONDS



Heating preforms in practically 1/60th the usual time is one reason why Thermex is stepping-up critical plastic production! It enables you to heat preforms as fast as your presses can handle them. Fast and uniform heating with Thermex gives you greatly improved flow and plasticity, together with more rapid cure. Mold closing pressures, closing time, curing time, insert breakage, mold wear, rejects . . . *all* are greatly reduced. Finish, quality, strength, unit costs . . . *all* are decidedly improved. Much larger and more intricate moldings can be handled with ease. Write The Girdler Corporation, Thermex Division, Louisville, Kentucky

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That's why C. P. C. has specialized in the development of resins for specific applications. That's why important industrial users come to C. P. C. for practical solutions to major resin problems.

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in which C. P. C. has solved resin problems for large industrial users:

- *A resin that gave new and greater strength and durability to plywood—a more lasting bond under extreme conditions.*
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- *A resin for compregnating airplane propeller wood—first to meet Army and Navy specifications.*

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Draw freely upon the knowledge and wide experience of C.P.C. We will gladly work with you on any resin problem; or discuss with you the possible advantage of using resins in any operation or process. Write Central Process Corporation, 1401 Circle Avenue, Forest Park, Illinois.

DEPENDABILITY IN PERFORMANCE. C. P. C. *stabilizes* production of *each* specification resin so that performance of *every shipment delivered is identical with the first.* The *extremely* close range of variation within which C. P. C. resins are held is evidenced by a laboratory inspection report—*with each shipment*—showing the complete chemical characteristics of the resin.

CPC

CENTRAL PROCESS CORPORATION

So it can't be done?

• No other material in the world has so quickly proved that "Can't Be Done," regularly takes a beating as has the tribe of plastics. What plastics may mean in a post-war world is barely glimpsed by their war uses. Owens-Illinois entered this war with years of plastic experience in making closures for containers. It will enter the post-war era with a deep understanding and wide experience of plastic accomplishments and possibilities in the packaging field.

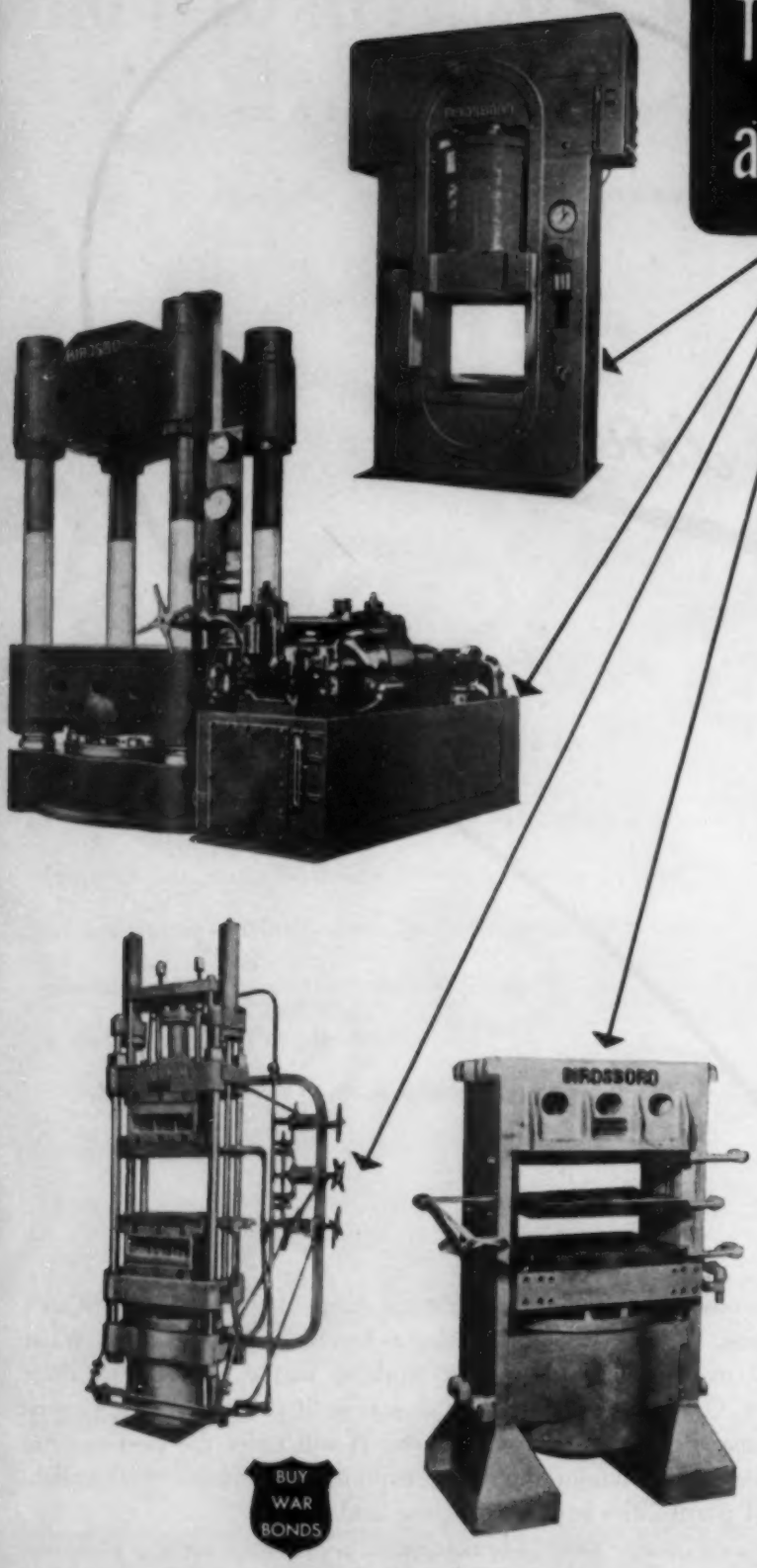
TUNE IN "BROADWAY MATINEE," presented by Owens-Illinois in co-operation with your government, every day, Monday through Friday, 4 P.M., E.W.T.; 3 P.M., C.W.T.; 2 P.M., M.W.T.; 1 P.M., P.W.T.

PLASTICS DIVISION

OWENS-ILLINOIS GLASS COMPANY

TOLEDO, OHIO

These Plastic Presses are doing Big Jobs...



● Ranging in size from 50 to 900 tons these Birdsboro Hydraulic Plastic Presses are proving their ability to do a big job when it comes to speeding war production and cutting maintenance costs.

Birdsboro specializes in building compression molding presses and multiple platen sheet presses for the plastic industry. Out of this experience has come diversified design "know-how". This knowledge can be applied in building a plastic press to meet your specific job requirements. Consult Birdsboro now.

For additional information write for the Birdsboro Hydraulic Plastic Press Catalogue.

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PLASTIC PRESSES
ARE BUILT IN SIZES
FROM AS SMALL AS
30 TONS TO AS
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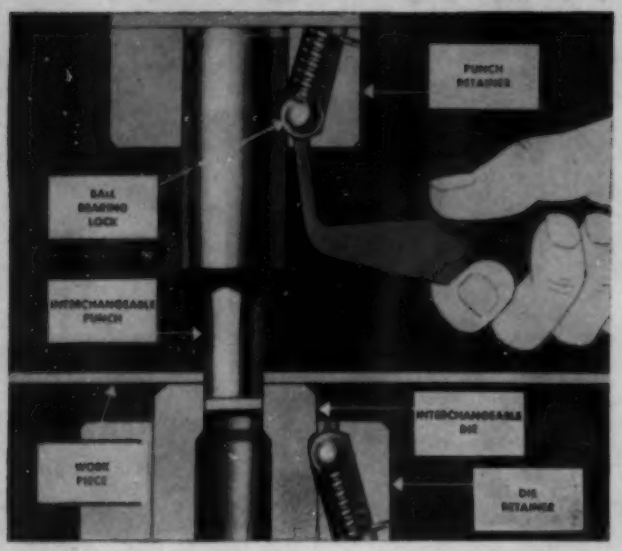
HYDRAULIC PLASTIC PRESSES

T O M O R R O W

Molders of Plastics

GENERAL MOLDED PRODUCTS · INC

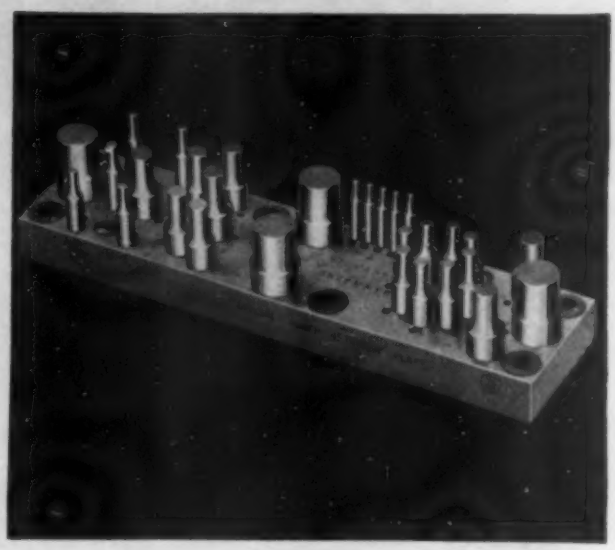
GENERAL OFFICE AND PLANT DES PLAINES • ILLINOIS



Showing the method of releasing either the punch or die simply by depressing the ball-bearing with special hand tool provided. Unnecessary to remove die from press.

A few of the special shapes produced in R-B Interchangeable punch points. They may be made of any material and in any shape or size to fit your job.

Service with a punch!



Special punch retaining plates are made where center distances are too close to use standard retainers. Hole sizes can be changed without affecting plate pattern.

BY RICHARD BROTHERS—

SOLE PRODUCERS OF THE ORIGINAL

INTERCHANGEABLE PUNCH AND DIE

For years the patented Interchangeable Punch and Die of Richard Brothers' Division of Allied Products Corporation has been in the service of the metal working industry —delivering a knock-out blow to production delays and high labor costs. Today it has become the accepted standard of efficiency in the field of laminated plastics as well. The wide application and money-saving possibilities of this "first aid" to multiple punching operations is indicated by the illustrations on this page. For a more complete preview of "Service with a Punch" write for the R-B catalog. Better still, bring your blueprints or layout problems direct to us.

"IT'S AN ALLIED PRODUCT!"— Allied Products Corporation and its divisions, Richard Brothers and Victor-Peninsular, in Detroit and Hillsdale, Michigan, also make: Sheet metal dies, steam-heated plastic molds, jigs and fixtures, cold forged parts, production parts, aircraft engine and gun parts, and other special precision products.

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★ ★ *All four plants have now added a star to their Army-Navy "E" Pennants* ★ ★

PROBLEM: Roller
Solid Plastic wheel in wide range of sizes with opening for metal pin or axle, dimensionally stable under constant pressure and resistant to severe service conditions.
SOLUTION: KYS-ITE
—the long-fibred wood pulp-filled synthetic resin plastic, preformed before curing.

Durability is a prime requisite for rollers and casters. Operating conditions are tough—constant stress, sudden shocks, overloads, abrasion, oil and grease on the floor. It's a job—one that calls for Kys-ite, the thermo-setting plastic that can "take it."

For a quick sketch of Kys-ite's advantages read the following digest. Then write for a more detailed analysis of its application to your plans.

GREAT STRENGTH AND LIGHT WEIGHT—Impact strength four to five times that of ordinary plastics and all the light weight advantages of Phenolic plastics. Withstands extreme torque and pressure without failure.

ADAPTABILITY—Can be molded with thin wall sections or heavy duty thick walls, and in intricate hollow forms. Dimensionally stable and suitable for close tolerance alignment with metal. Can be machined, drilled and decorated.

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FINISH—Wide range of medium to dark shades of beautiful opaque colors. Inherent lustrous smooth finish. Unaffected by grease, alcohol and boiling water.

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Our engineers are now working on numerous requests received during the last few months, and production schedules are being made accordingly. We custom mold to your specifications, delivering units complete for your use. May we suggest you contact us promptly?

ADVERTISEMENT

PRAISING THE BOONTON MOLDING COMPANY

FOR the first twenty years of our corporate existence we boasted of our age, we really wanted to be venerable. When you add to that the fact that a lot of us—executives, foremen and workmen—have earned our bread and butter in this plastic business for at least ten years before we gathered together as the Boonton Molding Company, you realize you are dealing with a lot of accumulated history of the industry. Knowledge and skill are gained in two ways—time and application. Time is bound to have its effect no matter how naturally dumb you may be, and we don't think we're dumb—that's just our opinion, anyway.

We have built slowly and painfully—oh how painfully sometimes—but we have built solidly and for all time, out of a basic knowledge of what was needed to do a bang-up job in the trade we have adopted for a life work. It was our own profits plowed back we had to work with and so we wasted nothing.

We made mistakes, frankly we still make them, but they are mistakes of enthusiasm, not ignorance. We are prone to try too much if we feel there is a chance of success and a great advance in sight should it work out right. We are machine minded—especially automatic machines. Too much so for our own good perhaps. We spent a lot of money we could ill afford on a wholly automatic molding machine different from anything in the world—and it works, too. We think it is the future of the molding business and sometime hope to have it on license all over the world. To us, it's the natural way to mold. We have seven running night and day in our own shop and plans for many more altho actual work on these had to stop temporarily—our minds and bodies are all for more serious things now.

A long time ago we set a physical limit on our size, but we have made a mess of that plan. Our prices are high, but so is our standard of service and, seemingly, our ability as an organization, and the demand has so steadily increased that we are constantly adding to our buildings and equipment. We own our land and so can spread as we wish—bounded only by the highway, the railroad, our neighbors and our finances. Fortunately, the physical limitations will stop us soon, which probably is a good thing for our finances. What we build is put up so we can sleep nights—and incidentally so our customers can also. It is of concrete and steel, thoroly sprinklered and amply insured with a company that is super fussy about details. The way they keep us stepping around we don't see how they can ever have a loss. The result is so good that many customers have waived their rule about two sources of supply after looking us over, and we've carried some pretty important production loads all by ourselves, altho we don't recommend it as a rule.

Our philosophy toward our business is also somewhat unique. We want to be the molding department of our customers. We want them to see our problems along with us, see their molds running, feel free to consult us even if it means no business. We've probably advised more prospects to use a screw machine, laminated part, or die casting, or even a piece of wood, than to go to plastics. A poor application in plastics, something that really has no business there, is our favorite nightmare. The attempt may have to be made, but the customer will know all the pitfalls, if there are any, if he is talking to us.

BMCB
ARMY
E
NAVY
BOONTON MOLDING COMPANY
MOLDERS OF PLASTICS · PHENOLICS · UREAS · THERMO-PLASTICS
BOONTON · NEW JERSEY · Tel. Boonton 8-2020
NEW YORK OFFICE
Chanin Bldg., 122 East 42nd Street, New York 17, N. Y., MUrray Hill 6-8540

WATER-STABLE CELLULOSE Acetate provides an efficient toilet float, supplanting war-precious metal. Molded of Celanese-Celluloid's LUMARITH by Allied Plastics Corp.

UNAFFECTED BY BATTERY ACIDS, these wet-cell housings for the Dewar Portable Searchlight are made of Cellulose Nitrate sheet stock by Nixon Nitration Works.

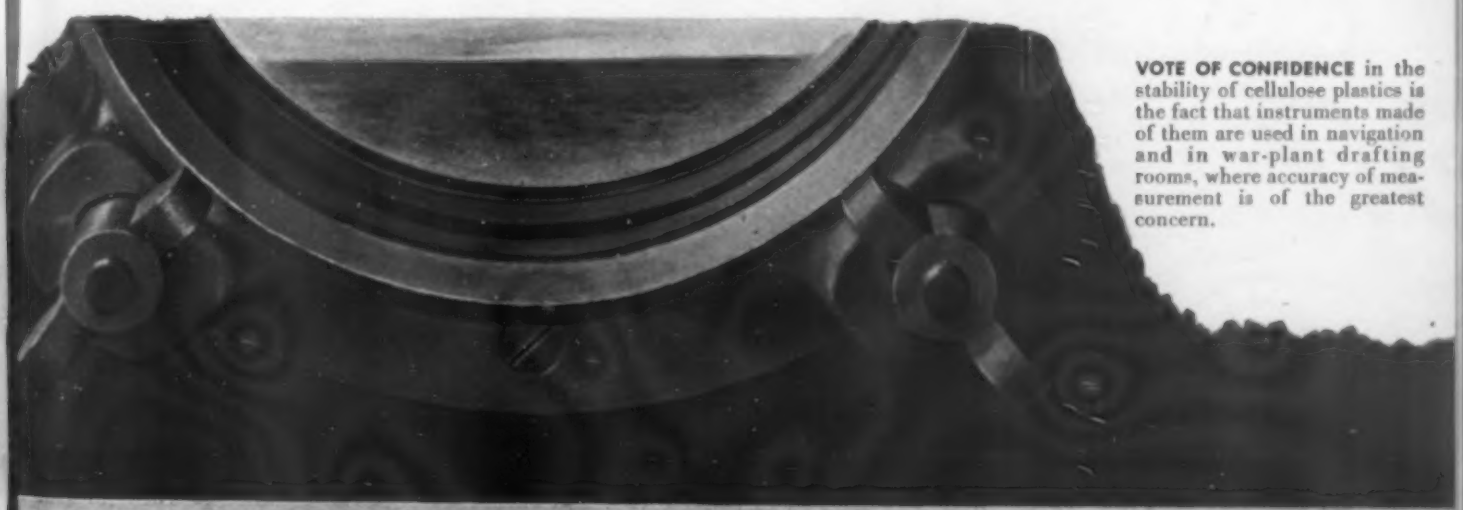
ITS CHEMICAL STABILITY makes Cellulose Acetate an ideal lightweight material for the film-developing tray used in flight or at base by the Army Air Forces photographers.

CELLULOSE PLASTICS ARE *STABLE*!

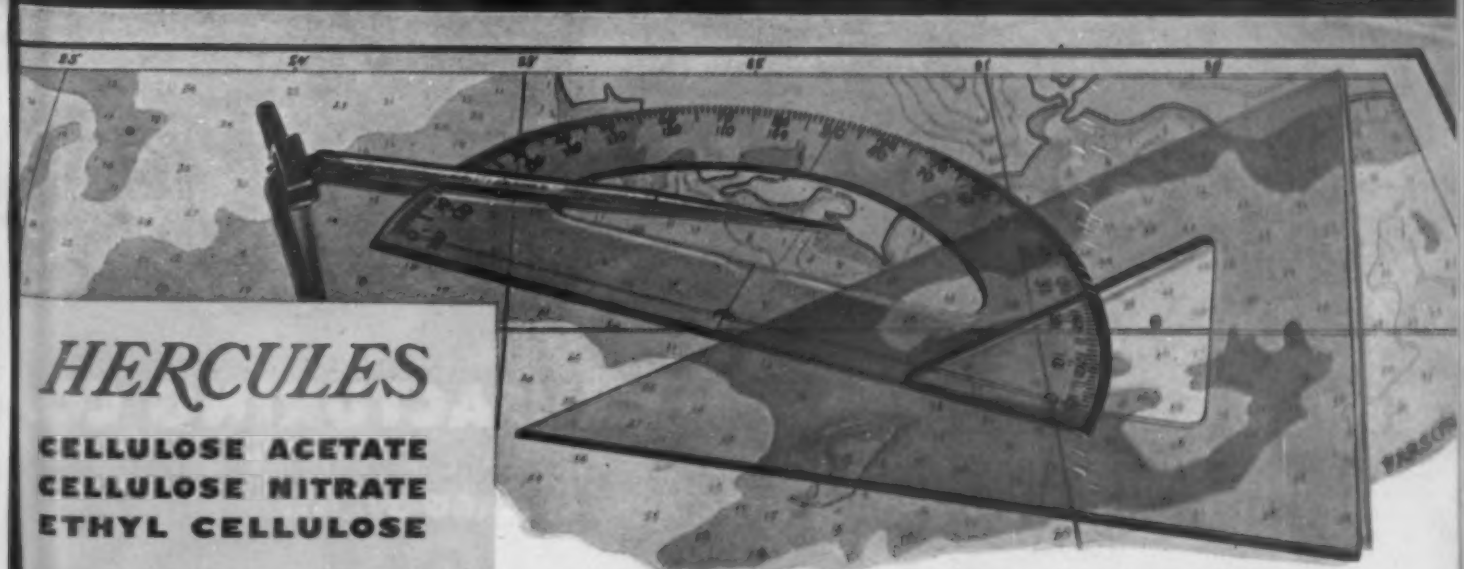
Stable over a wide and useful temperature range . . . resistant chemically to a wide variety of alcohols, acids, gasoline, and many other chemicals . . . successfully used in a multitude of exposures to humidity, weather and water: these are *other* important reasons why the cellulose plastics, unique in their combination of advantages, are being used in more and more exacting applications—both for the Armed Forces programs, and for the many products of peace.

Hercules does not make plastics, but as a leading producer of cellulose derivatives—Cellulose Acetate, Cellulose Nitrate, and Ethyl Cellulose—we are working constantly to supply those who do make plastics with even better and more versatile base materials. For literature and data based on our years of research, address Cellulose Products, Department MP-44,
Hercules Powder Company, Wilmington 99, Delaware

TOUGH · FLEXIBLE · STABLE · CLEAR · ECONOMICAL · LIGHTWEIGHT



VOTE OF CONFIDENCE in the stability of cellulose plastics is the fact that instruments made of them are used in navigation and in war-plant drafting rooms, where accuracy of measurement is of the greatest concern.



HERCULES

CELLULOSE ACETATE
CELLULOSE NITRATE
ETHYL CELLULOSE

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THIS PLANT IS YOUR PLANT

- the rows of latest type machines...
- the volume capacities for molding precision injection and compression plastic parts...
- the trained production staff...
- the sound, straight-thinking engineering of Chicago Die Mold Manufacturing Company
- can team with your own organization as if it were an integral part of it...
- call on us for full assistance in present plastic problems, and in profit-building plastic developments for postwar.

E. G. Peterson

CHICAGO DIE MOLD MANUFACTURING CO.

CUSTOM MOLDERS OF PLASTICS

4001 WEST WRIGHTWOOD AVE., CHICAGO 39, ILL.

FIBRE

. . . IS IN THE FIGHT!

TONIGHT . . .

Somewhere at sea a convoy churns through the darkness. Below, in the holds of these ships, rides essential military supplies for the front — shells, fuses, bombs, food, blood plasma — many of them protected in strong Fibre-board boxes made of Hopewell Kraft.

TOMORROW . . .

Boxes made of Hopewell Kraft will ride the invasion barges with our boys when another landing is made, another beach-head established. Hummel-Ross is proud of its part in these movements.

ANOTHER TOMORROW . . .

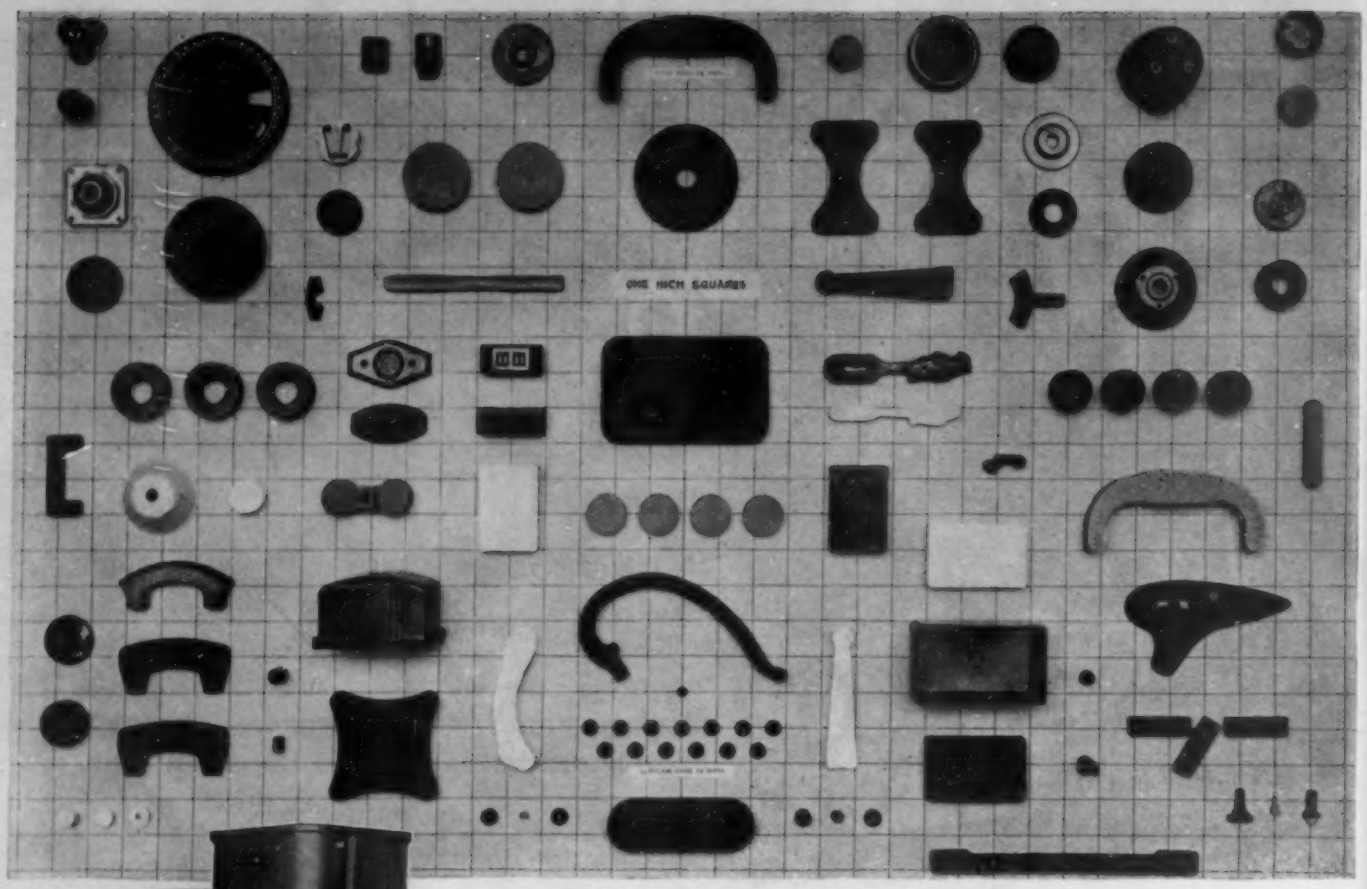
And all calls to duty will have been answered. Hummel-Ross Laboratory and Research men are even now looking across that brighter horizon into a new future for Kraft papers and fibre board with new products, plastic bases — and new uses for old products — bearing that familiar trade-mark — Hopewell Kraft.

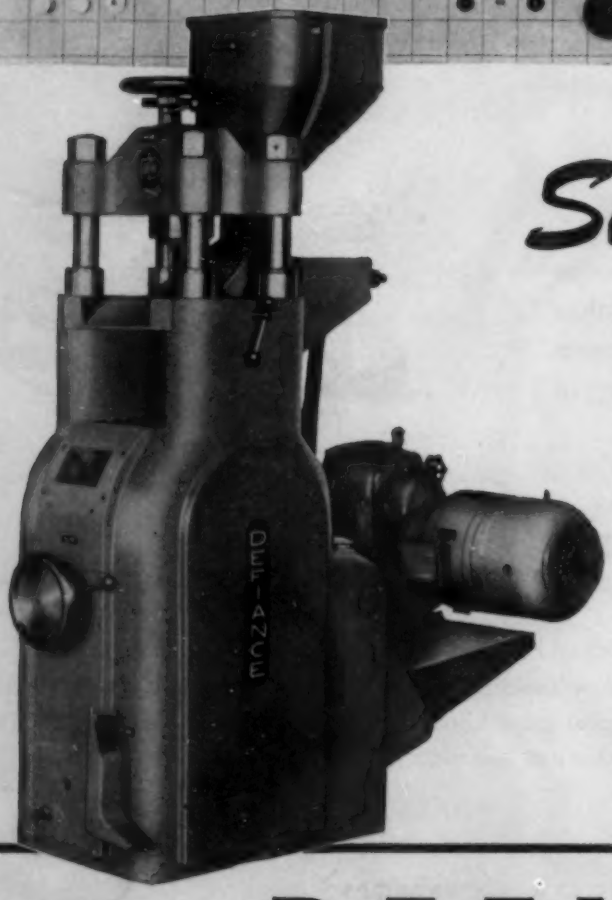
ORIGINATORS ★ CREATORS

HUMMEL-ROSS

FIBRE CORPORATION

HOPEWELL, VIRGINIA, U. S. A.





WIDE RANGE OF
Shapes and Sizes

● Big pills... little pills... tablets in a *wide variety of shapes and sizes* can be produced on the Defiance Plastic Preforming Machines. Weights of preforms can be rapidly changed—without even stopping the machines. Designed to reduce die cost. Tools can be quickly interchanged.

Greater Cleanliness with these machines—and a minimum of "down time" for cleaning—because it's easy to change colors. Material leakage during operation reduced to a minimum.

Greater Uniformity in weight and density—with high speed production—assured by exclusive features of Defiance design. This keeps waste and costs *down*—efficiency *UP!* Do your plastic preforming *better* with Defiance! Write for more facts. Defiance Machine Works, Inc., Defiance, Ohio.

DEFIANCE
Plastic Preforming Presses

Three materials teamed up in this STOP sign to do a superb job; Alcoa's Alzak* reflector sheet, glass beads, and a plastic bond.

Alzak aluminum sheet is a super-reflector of light. That's why it was so popular for lighting work, before the war started taking all of the aluminum we could produce. But tiny glass beads, superimposed on that surface, impart a brilliance which causes headlight reflections to be picked up more readily. Holding those beads on the aluminum surface called for an adhesive which could withstand the weather. So that's where the plastic entered the picture.

*Registered Trademark

You're going to see a lot of this kind of teamwork, when the manufacture of peacetime products can again be resumed. And Alcoa Aluminum makes a good material to start with. It gives you lightness, strength, durability, fine appearance, ease of fabrication, together with its other advantages. First costs promise to be surprisingly low.

If the projects you are working on have special requirements, Alcoa engineers will gladly help you determine what materials will work best in combination with aluminum. Write ALUMINUM COMPANY OF AMERICA, 2175 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA ALUMINUM

When the astronomical quota on U. S. plane production was set, aircraft manufacturers needed special presses, as quick as *yesterday*.

Fortunately, Baldwin didn't have to stop and learn *how* to build such equipment; 30 years of experience in building thousands upon thousands of presses took care of that. Manufacturers told what they wanted the presses to do . . . and Baldwin built them to do it.

You may have some production problems . . . current or post-war . . . that the right press could solve better than anything else. If so, the same Baldwin brains that served the aircraft industry are ready to serve you. Baldwin Southwark Division, The Baldwin Locomotive Works, Philadelphia, Pennsylvania, U. S. A. Pacific Coast Representative: The Pelton Water Wheel Co., San Francisco, California. In Canada: United Steel Corp., Toronto.

BALDWIN
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Hydraulic presses
Testing equipment
Steel forgings and castings
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Diesel engines
Metal plate fabrication
Rolled steel rings
Bronze castings
Heavy machine work
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Babbitt metal
Alloy iron castings
Briquetting presses

BLW THE BALDWIN GROUP

BALDWIN
SOUTHWARK
HYDRAULIC PRESSES

VENTURI IN PLASTICS

The Venturi tube is a conversion from metal to plastics.

Actually, the plastic Venturi (molded in two pieces of ethylcellulose) is more efficient than metal. Molding tolerances meet heretofore unheard of ±.002. It passes unusual weather, distortion, heat, cold, impact tests.

The plastic Venturi must be perfectly aero-dynamic to set up exact air currents which operate the gyro in the airspeed indicator in the plane.

Indoors or out, Cruver plastics stand up under the most difficult stresses. File the name for post-war requirements.

Here's a case where plastics meet close tolerances—the molded Venturi tube. Of ethyl cellulose by Cruver.

Cruver

MANUFACTURING COMPANY

NEW YORK
2 West 46th St.
Wisconsin 7-8947

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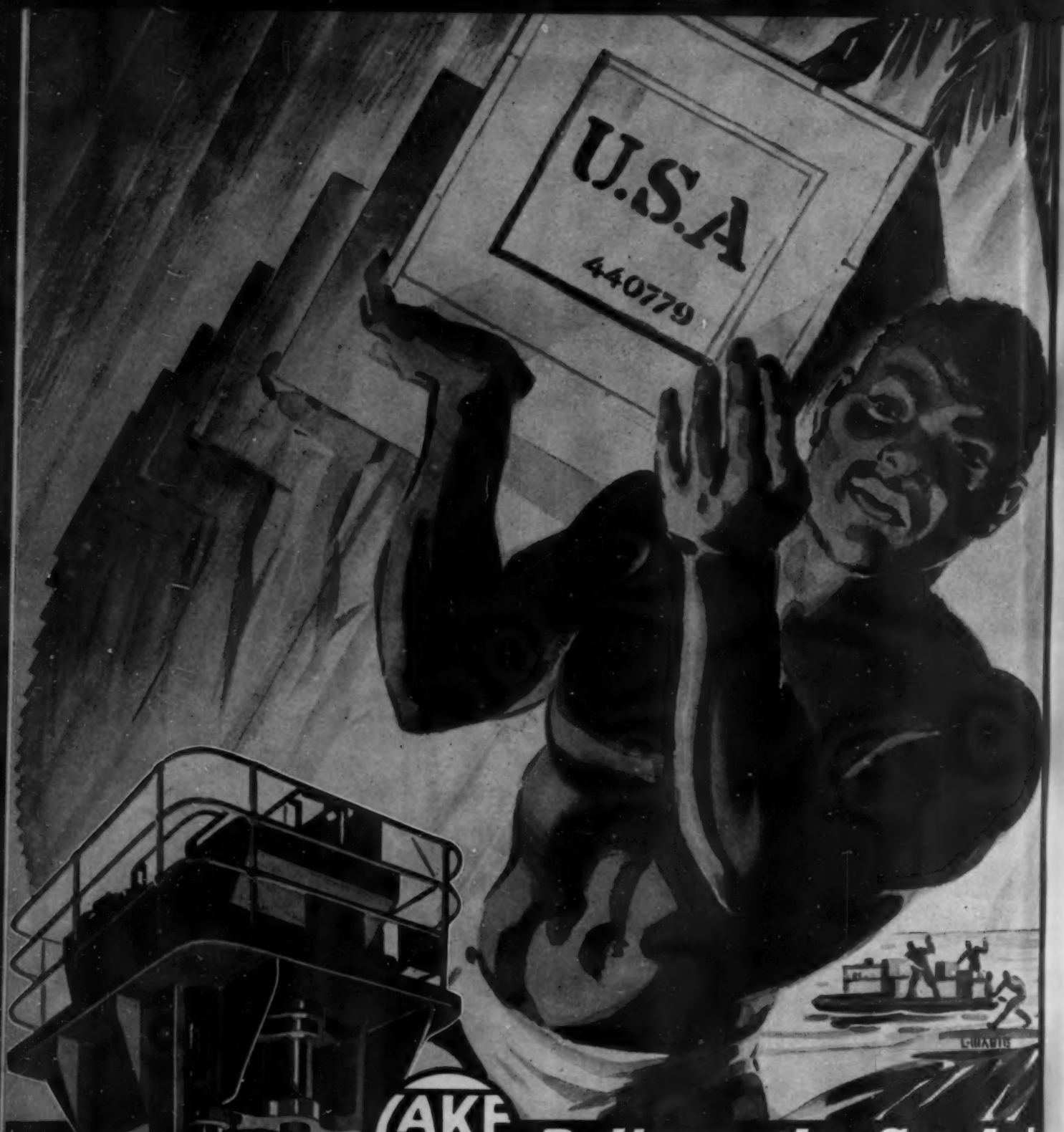
Met. 5-900, Ext. 650

SPECIALISTS IN CONVERTING PLASTICS TO WAR

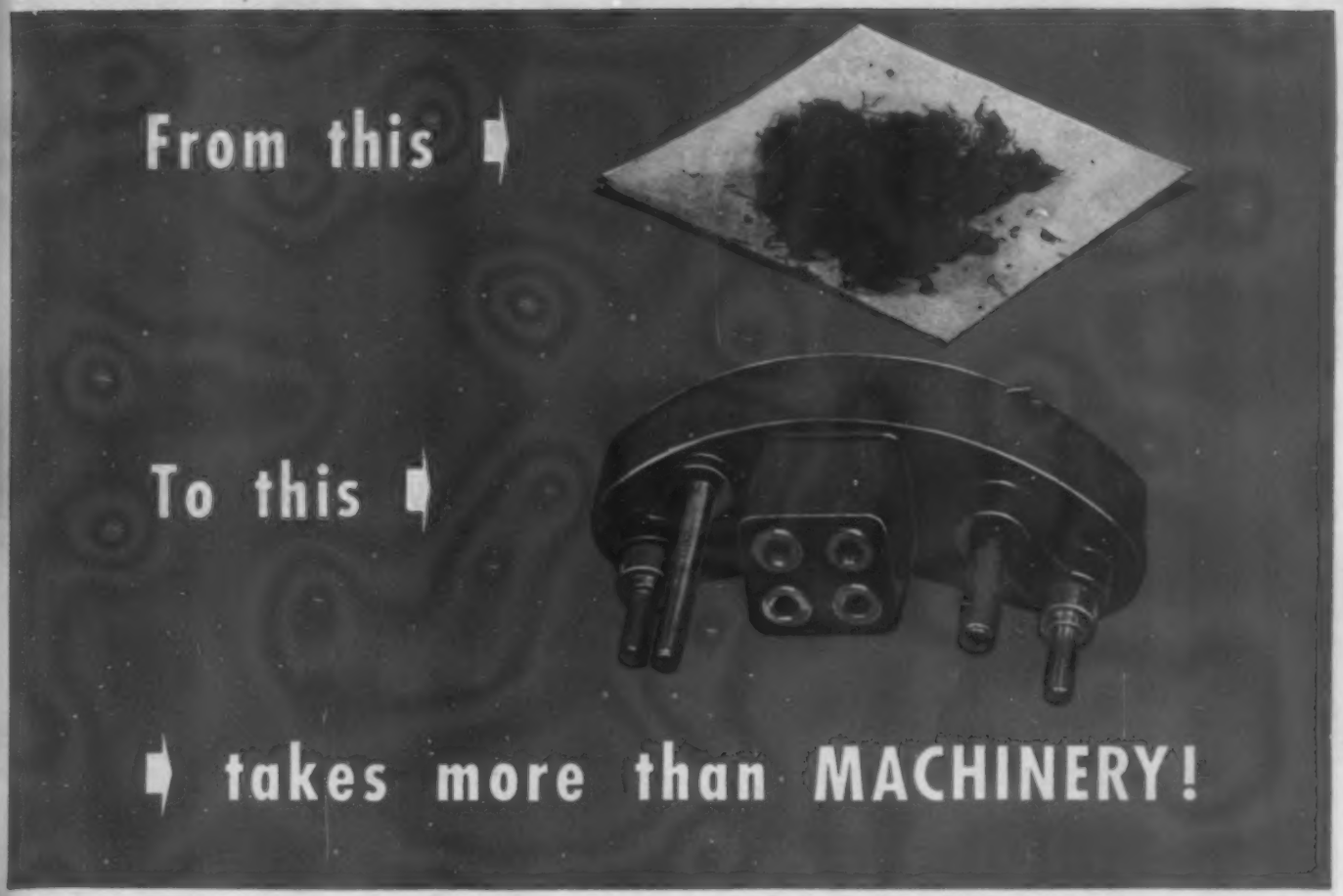


LAKE ERIE

Delivers the Goods!

Products of dependable precision and exacting tolerances for a multitude of War uses are being shaped on LAKE ERIE Hydraulic Presses to carry on the war on every front.

LAKE ERIE ENGINEERING CORPORATION • BUFFALO 17, NEW YORK



Under ordinary conditions, anybody can buy raw plastics and molding machinery and go into the plastic molding business.

But they can't buy what we have here at General Industries . . . and that's *experience.* (Call it "know-how" if you want to.) They can't take a barrel or a ton of raw materials and turn it into intricate, complicated castings.

Experience recognizes the characteristics of the various kinds of plastic materials . . selects the best one for the job in hand. Likewise, it knows the intricacies of making molds with micrometer tolerances, in all sorts of shapes and sizes, with inserts that must be accurately placed. And, experience knows the right machines to do the job on, to turn out finished products exactly to specifications and on time. Perhaps most important, experience knows what *is* a plastic job and what *isn't!*

That's what we have at General Industries. Of course we have presses, large ones and small ones. Presses that will turn out the work as perfectly as we have turned out the molds, and in the most economical way.

So—if you have a plastic problem on a postwar product, perhaps we'll be able to help you. Right now, our men and presses are busy helping Uncle Sam finish up the work in hand. But later . . . we'll want work to keep them busy. We'll have engineers that will help you fit plastics to the job you want them to do. We hope you'll call on us.

THE GENERAL INDUSTRIES COMPANY

MOLDED PLASTICS

Molded Plastics Division • Elyria, Ohio

Chicago: Phone Central 8431
Detroit: Phone Madison 2146
Milwaukee: Phone Daly 6810
Philadelphia: Phone Camden 2215

Scratches are fatal because they mean rejections! In the case of bronze bearings and bushings for important war-time requirements, scratches occurred when these items came in contact with each other during various phases of production and shipment. The answer? An H & D war-time packaging development that provides positive product protection throughout the entire production and shipping cycle.

H & D Package Engineers are not only devoting much time to war-time packaging but are also turning their attention to the packages of tomorrow.

Post-war packages must receive the same careful planning as the products entrusted to them for safe arrival. Damaged deliveries never create customer good-will. So plan *now* for your post-war packages, and plan to use corrugated boxes that both protect and promote your products. H & D's vast storehouse of war-time packaging information is available now for planning peacetime packaging. Write today.

BUY WAR BONDS — YOUR SAFEST INVESTMENT

Tells HOW to PACK War Materials in Corrugated Boxes

The chief requirement in packaging war goods is to get as much essential material to specified destinations in the fastest, safest, most economical way. "How to PACK WAR MATERIALS in Corrugated Boxes" tells how H & D boxes are effecting new shipping efficiencies and economies in important war packaging assignments. Get copies of this and other H & D Little Packaging Library booklets by writing The Hinde & Dauch Paper Company, Executive Offices, 4475 Decatur St., Sandusky, O.

• • •

FACTORIES in Baltimore • Boston • Buffalo • Chicago Cleveland • Detroit • Gloucester, N. J. • Hoboken Kansas City • Lenoir, N. C. • Montreal • Richmond St. Louis • Sandusky • Toronto

For postwar packaging . . better see **H&D HINDE & DAUCH**

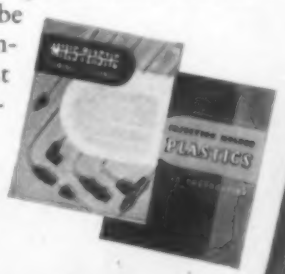
AUTHORITY ON PACKAGING . . . CORRUGATED SHIPPING BOXES

One day nearer Victory ... and Peace

Mankind's entire progress has been based on Hope, and constant striving for a better way of life. Today, during the world's greatest crisis, it is more important than ever that we all keep before us the promise of a better world . . . or Hope, too, will be among our casualties.

Among the great promises of the new era of prosperity to come, are thermoplastics. Now, they are being featured in hundreds of important uses . . . as replacements for vital materials needed elsewhere in the war effort.

And, in the present all-out drive, our highly trained personnel, too, are wholeheartedly devoting their time and energy to producing for Victory. But, their thoughts and their Hope are on the future, when the "Four Freedoms" will be our passwords to Progress. In the meantime, if you have any war or postwar problems, our engineering and creative staffs will be glad to assist you. They will be happy to give you the benefit of our continually growing experience with the most recent developments in molding and extruding materials.



Write on your letterhead for the Injection Molded and Extruded Plastics Catalog III or for the MILLS-PLASTIC* *tubing and fittings circular.* **Made of Saran.*

ELMER E. MILLS CORPORATION

Molders of Tenite, Lumarith, Plastacele, Fibestos, Lucite, Crystallite Polystyrene, Styron, Lustron, Loalin, Vinylite, Mills-Plastic, Saran and Other Thermoplastic Materials

153 WEST HURON STREET, CHICAGO 10, ILLINOIS

THE "BAKER'S DOZEN"

The "baker's dozen". . . .
It counts as an extra value! It is a bonus that good-wills itself a long way!

We know of an Industrial Hard Chromium-plated mold that has just passed its two millionth operation . . . is removed from the manufacturer's press only to make way for other work . . . and then goes right back into the press again, to add still more numerals to its perfect performance.

The molder is inclined to credit this record to the hard chromium plating. And we're very happy to accept his inclination for we do have a way with dies that assures bonus production. Call on us, therefor, whenever you are in the market for the "baker's dozen" type of mold satisfaction.

INDUSTRIAL HARD CHROMIUM CO.

"Armorplate for Industry"

15 ROME STREET • NEWARK 5, NEW JERSEY

SAVE THAT METAL with METEX Plastic Stripper

Salvage Metal Inserts from Plastics

Eliminate the time-costly and troublesome, often impractical, work of chipping or burning plastics from metals by using this new scientific method of salvaging.

METEX *Plastic* STRIPPER has been recently developed after many months of practical experimentation and is now available for easy, economical stripping of inserts from most plastics.

Metals, excepting aluminum and zinc, can now be easily removed by immersion in a water solution of METEX *Plastic* STRIPPER, using an iron basket and left to soak until plastic disintegrates leaving metal clean and unchanged ready for re-use.

SPECIAL *Introductory* TRIAL OFFER

A MAC DERMID INCORPORATED Service Engineer will be pleased to demonstrate the many remarkable qualities of this new METEX stripper or, if you prefer to test it by yourselves, we will make an initial shipment of a 100 lb. container at the special introductory price of only $14.00 F.O.B. Waterbury, Connecticut.

WRITE FOR *Free* DATA SHEETS

MAC DERMID

INCORPORATED

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WRITE ONE OF THESE SERVICE ORGANIZATIONS FOR FREE DEMONSTRATION

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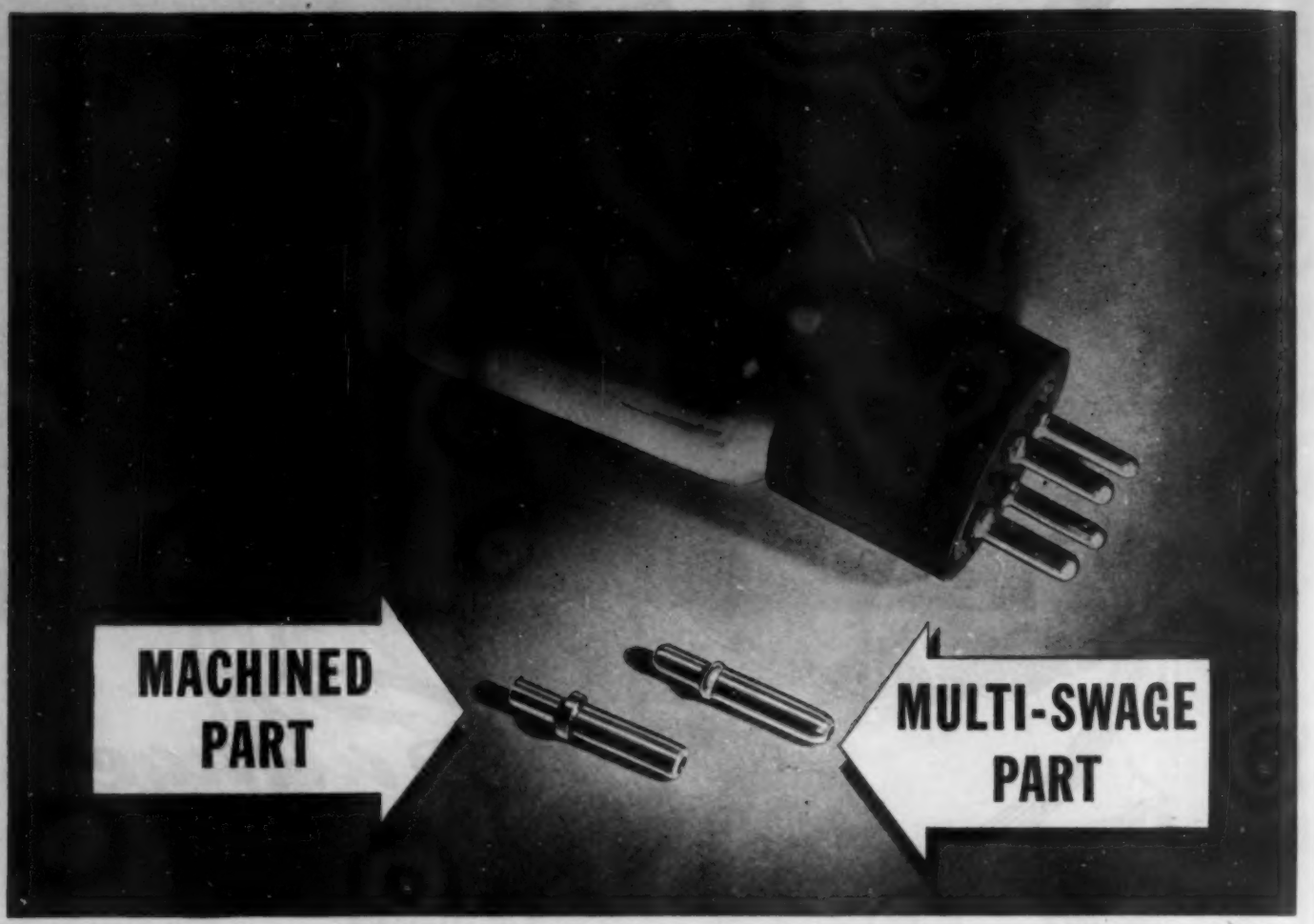
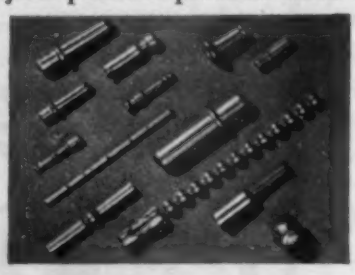


Why most electronic tube contacts are made by MULTI-SWAGE

ORIGINALLY, electronic tube contacts were machined out of solid rod of a section as large as the largest diameter of the finished piece. The center hole was drilled out. When made by the Bead Chain "Multi-Swage" Process, contacts are automatically swaged from flat stock. As no machining or drilling are required, there is no waste from cutting down or drilling. Therefore the economy of "Multi-Swage" is considerable.

Savings of over seventy-five percent in the cost of finished contacts has been realized by electronic tube manufacturers through the use of "Multi-Swage" parts. Assembly, also, proved less costly. Any number of "Multi-Swage" contacts can be staked-in simultaneously.

It is well worth your while to see if the small solid or hollow cylindrical metal parts you are using can be made by the "Multi-Swage" Process. Our Research and Development Division will gladly work with you. Plan to have the parts of your post-war products made by "Multi-Swage."



These are typical "Multi-Swage" products. This process will turn out large volume speedily while maintaining close tolerances accurately.

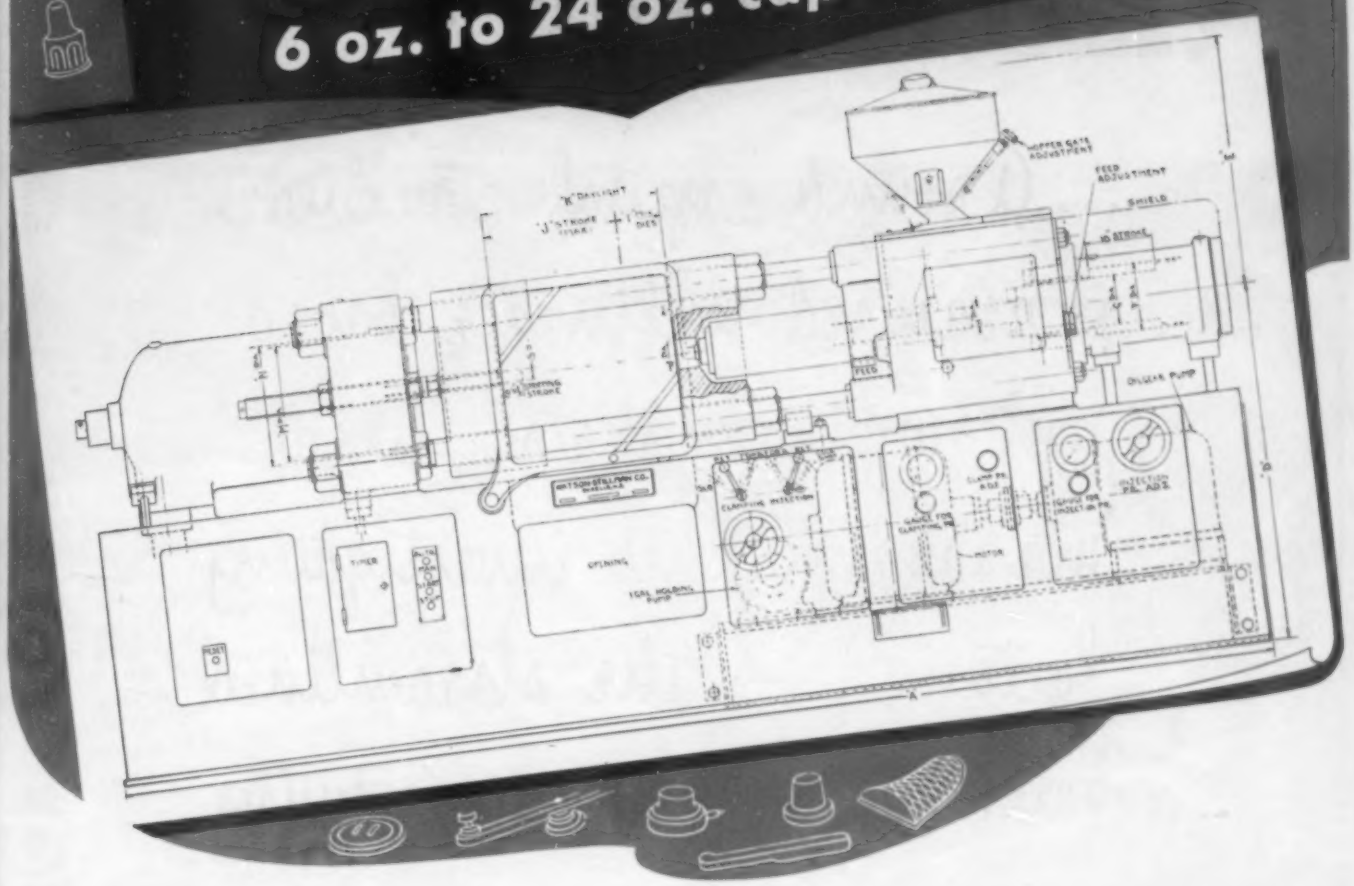
Back the Attack BEAD CHAIN **multi-swage** PROCESS *Buy War Bonds*

THE MOST ECONOMICAL METHOD OF PRODUCING SMALL METAL PARTS TO CLOSE TOLERANCES WITHOUT WASTE

THE BEAD CHAIN MANUFACTURING COMPANY

Improved INJECTION MOLDING MACHINES

6 oz. to 24 oz. capacity



Higher Plasticizing Capacities at Lower Temperatures

Here's another Watson-Stillman contribution to better molding of plastic parts – an improved line of Horizontal Injection Molding Machines in 6 oz. to 24 oz. capacities. They are an entirely new design which has been developed and thoroughly tested in the Watson-Stillman laboratories to provide higher plasticizing capacity at lower temperatures, and reduce pressure loss within the cylinder. The heating cylinder bracket design allows the choice of three or four cylinders for each machine. Changing the plastic in the cylinder may be done without removing the unit from the machine. Inclusion of zone heating control meets the requirements of a wide variety of materials.

Large mold platens are bronze bushed and move on four strain rods thus assuring positive alignment of molds. Rod spacing allows ample room for large molds, attachment of auxiliary mold equipment, and accessibility in removing moldings. The base is welded steel, all platens are cast steel, and strain rods are forged steel of ample dimensions. Heating cylinder and plunger are heat-treated alloy steel. Automatically controlled hydraulic clamping eliminates the necessity of adjustment for varying mold thicknesses. Definite clamping capacity is assured by use of a holding pump whose pressure is adjustable over a wide range without any connections with the injection power unit. The double pumping unit, hydraulically controlled, is mounted on a base with the oil tank, and is easily removed for repair or servicing.

The high speed of these machines recommends them for any plastic molding operations where rapid production of a variety of parts from different materials is planned. Ask for Bulletin 621-A containing complete specifications. The Watson-Stillman Co., Roselle, N. J.

WATSON-STILLMAN

DESIGNERS AND MANUFACTURERS OF HYDRAULIC EQUIPMENT, FORGED STEEL FITTINGS, AND VALVES

Post War PLASTIC Sales

... A sound capital structure is required to finance broad post war markets. Alert management is investigating factoring — the streamlined banking of prosperous industry.

BOOKLET ON REQUEST

COLEMAN & COMPANY

FACTORS · ESTABLISHED 1912

468 FOURTH AVENUE • NEW YORK CITY

MOST VERSATILE War weapon OF THEM ALL!

Actual weapons of war are designed for specific purposes. They can rarely be adapted to other uses. Not so with plastics which have proven such an effective weapon in war production. To overcome two of our most critical bottlenecks . . . shortages of rubber and metals . . . plastics have breached a vital gap in our program and won distinction that time can never dim.

Auto-Lite has frequently demonstrated to manufacturers and engineers the marked superiority of parts and complete articles produced from plastics by injection or compression molding. Perhaps we can show you, too, an important saving in delivery time, actually superior performance along with a substantial reduction in cost through the use of this new medium.

1 Distributor Caps assume many shapes conforming to location and design. Long in mass production by "Bay" from plastics by compression molding.

2 Plastic Grommets for vehicle and aircraft use offer rubber's resiliency plus resistance to hardest service.

3 Aircraft Instrument Cases fitting snugly into the complicated panels of planes are fast replacing metal through their substantial saving in weight and insulating features.

4 Instruction Plates of transparent Vinylite or acetate with decoration on back, can be stamped with serial numbers and other data on front.

5 Phenolic Plastic Panel for parts on aircraft and vehicles. Has clearly defined characters in contrasting colors.

THE ELECTRIC AUTO-LITE COMPANY
Bay Manufacturing Division
BAY CITY MICHIGAN

Specify
AUTO-LITE PLASTICS
FOR THE DURATION . . . AND AFTER

Make Sure of ENGINEERING when you choose your Plastic Molder

Engineering is only one of the functions a Plastic Molder must perform . . . but it's a vital one. And we'll whistle *that* again!

Because without a thorough knowledge of toolmaking, molding compounds and molding techniques, ideas never become blueprints, and blueprints never become products. That's why we forever feature engineering functions at Kurz-Kasch.

From the blueprint to the finished parts, of course, more specialized skills are called for. Here at Kurz-Kasch, they all find a common meeting place with your engineers at the Plastics Round Table . . . where a generation of experience in plastics is pooled to work out the best Engineering and Production treatment of your application.

Behind all this lies the production capacity of a large and modernly equipped plant which we confidently expect to keep quite busy after the war. We know, because right now we're talking Engineering on many products for customers both old and new. If you're interested in Plastics —now's the time! No obligation.

THE EARLIER Engineering gets on the job, the better! When you look at a top-notch plastic application, it's ten to one that the Custom Molder sat in on the job from the ground floor up. Let us help with blueprints *and* molding material specifications.

WAR BONDS BUY VICTORY—HAVE YOU BOUGHT YOURS TODAY?

KURZ-KASCH

For over 25 years Planners and Molders in Plastics

Kurz-Kasch, Inc., 1421 South Broadway, Dayton 1, Ohio
Branch Sales Offices: New York • Chicago • Detroit • Indianapolis • Los Angeles • Dallas
St. Louis • Toronto, Canada. Export Offices: 89 Broad Street, New York City

DU PONT FORMALDEHYDE

U. S. P. Solution for Plastics Manufacture

Rigid control in the manufacture of Du Pont Formaldehyde means *quality* you can depend on in making casting or molding resins, casein plastics, varnish resins, and adhesives. Consider the outstanding advantages of Du Pont Formaldehyde, which will assist *you* in the faster, more efficient production of these products.

HIGH PURITY—simplifies consistent production of quality plastics.

UNIFORM STRENGTH—removes much of the uncertainty regarding yields and quality of both finished plastics and products made from them.

WATER-WHITE COLOR—a requirement for making clear, white or delicately tinted materials.

LOW ACIDITY—minimizes corrosion of apparatus; simplifies control of reactions.

★ ★ ★

Shipment can be made *now* in tank cars, tank trucks or in modern containers, from adequate stocks carried in the principal cities.

AVAILABILITY

Production has been expanded so that now prompt shipment of any quantity can be made. Consult our nearest Office about your requirements.

WPB Allocation Order M-25 as revised January 6, 1944, now permits purchase under "Small Order Exemption" of quantities up to 10,000 lbs. of Formaldehyde, 3,000 lbs. of Paraformaldehyde and 10,000 lbs. of Hexamethylenetetramine in any calendar month. These quantities can be obtained without application.

Quantities in excess of the above still require application on form WPB-2945 (PD-600).

Also

PARAFORMALDEHYDE

Powdered or granular, minimum strength 95%

HEXAMETHYLENETETRAMINE

U. S. P. Crystals and Technical

★ ★ ★

Information and technical assistance on the use and handling of these materials are available from the Electrochemicals Dept., E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Del.

LET'S ALL BACK THE ATTACK!

DU PONT ELECTROCHEMICALS

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

Compression Molded "LUCITE"

- Close tolerances maintained !
- Better dimensional stability !
- No weld lines or gate marks !
- Mechanically stronger !
- Die cost allows short runs !

ARNOLD Brilhartz LTD.

435 MIDDLE NECK ROAD · GREAT NECK, N.Y. · *Phone* GREAT NECK 4054

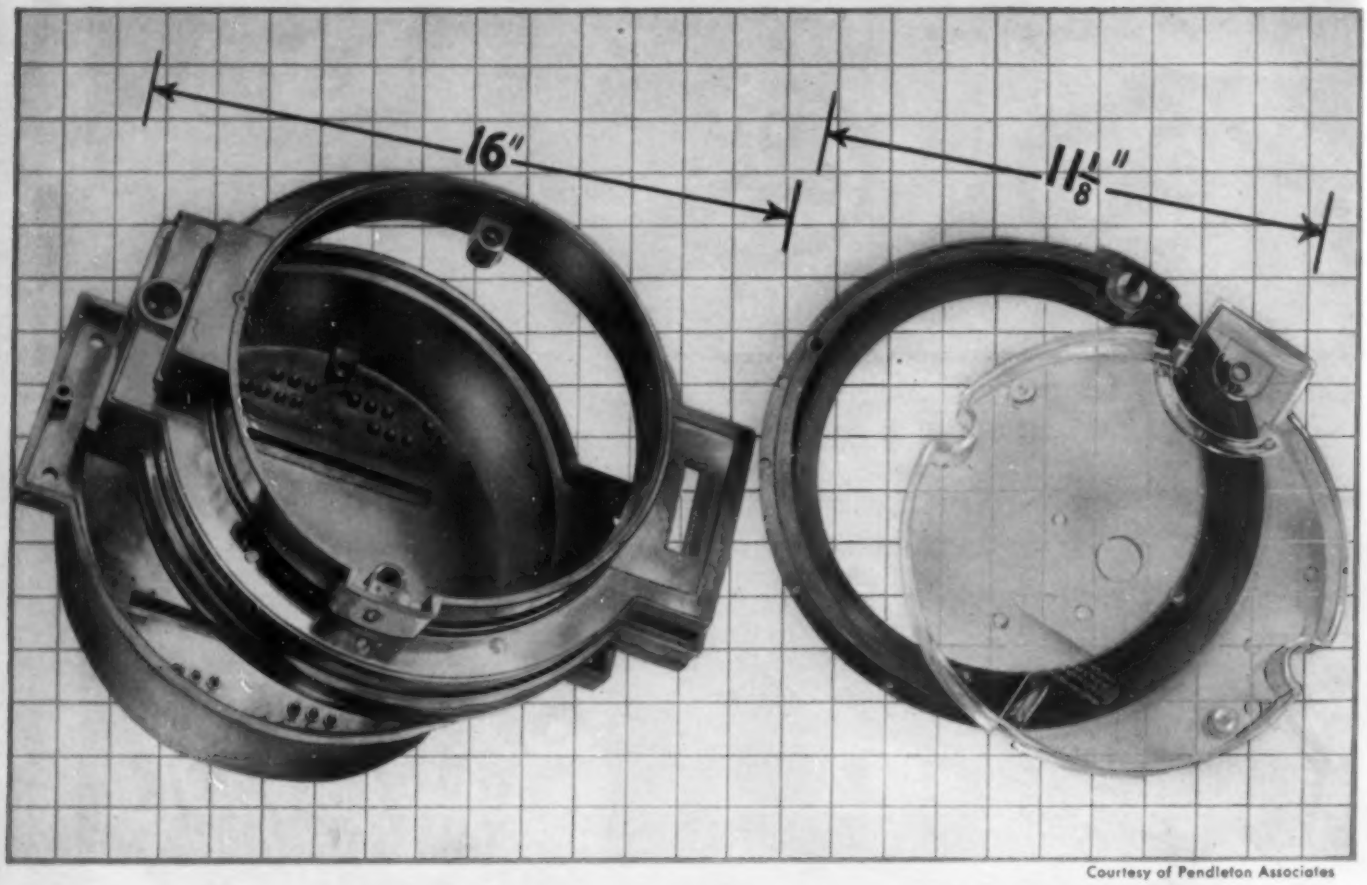
The price you pay may be *big* if that chair of the paper technician remains vacant . . . opportunities for bettering your product, expanding your market, lowering your costs, may be missed . . . profit opportunities may remain hidden.

Developments in essential papers in the past few years have been more important than ever before in the history of industrial paper production. More rigid scientific controls of paper properties have been perfected. New functions for paper have been discovered . . . critical materials have been replaced by paper.

The pattern for still greater progress in essential papers has been formed. Forward-looking manufacturers concerned with present or postwar improvements in products and production processes, are inviting Mosinee paper technicians to fill that "vacant chair" now. Mosinee is ready to help you "make the most of PAPER."

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

Please address your letter "Attention Dept. B"



Courtesy of Pendleton Associates

NO JOB FOR AN AMATEUR

It is not an easy job to provide accuracy of steam measurement equal to electric metering. Neither was it an easy job to mold the major plastic parts appearing in Precision Meters designed by Pendleton Associates, steam service specialists of New York City.

Both a thermoplastic (polystyrene) and a phenolic material (Neillite*) were required, and injection and compression molding were employed to produce the housing. Metal inserts, two 8" tube-channels, 34 molded contact points and a variety of special cavities are incorporated in shapes that are complicated and also extraordinarily large. Watertown has facilitated molding of the thermosetting parts by use of Megatherm—a high frequency electronic heating unit, which eliminates distortion and produces a stronger, completely homogenized plastic that withstands unusual strains.

Our 29 years' experience in solving plastics problems may help you to find the answer to *your* problems. Let our engineers work with you on details of design and materials.

THE WATERTOWN MANUFACTURING COMPANY

WATERTOWN, CONNECTICUT

Branch Offices in Chicago • Cleveland • Detroit • New York City

* Neillite special formula 6017, made by Watertown

Watertown

A NAME AS OLD AS THE PLASTICS INDUSTRY

On the Nose! It's Plexiglas

In nose sections on American heavy and medium bombers, PLEXIGLAS gives crystal-clear, unobstructed vision . . . protects the gunner from wind and freezing weather . . . saves precious flying pounds!

ON THE MARTIN B-26

ON THE BOEING B-17G

ON THE CONSOLIDATED B-24

ON THE NORTH AMERICAN B-25

PLEXIGLAS, developed in Rohm & Haas laboratories, makes possible the familiar plastic "greenhouse" that is the modern bomber's nose—and *eyes!*

Clear As Finest Optical Glass

Transparent PLEXIGLAS enables the nose gunner—and gunners in the turret, belly, waist and tail—to aim and fire with deadly accuracy. This transparency is permanent, undimmed by time or extended weathering.

Saves Precious Pounds

The strength of PLEXIGLAS is also permanent, providing constant protection from wind, weather and freezing slipstreams. Yet PLEXIGLAS is only half as heavy as ordinary glass, permitting our bombers to carry bigger bomb loads and longer fuel supplies.

Technical Service

In addition to these inherent advantages, every piece of PLEXIGLAS also carries with it the cooperation of the Rohm & Haas technical service staff...its physicists determine the best optical contours for sighting...its engineers discuss mechanical details . . . its production men with facilities to fabricate experimental sections.

You are invited to take advantage of this able assistance in your own development work with plastics — present or postwar. Simply call the nearest Rohm & Haas office —Philadelphia, Los Angeles, Detroit, Chicago, Cleveland, New York. Canadian Distributor: Hobbs-Glass Ltd., Montreal, P. Q.

***Only Rohm & Haas makes* PLEXIGLAS**

3 awards to Rohm & Haas Company and its associated firms, The Resinous Products & Chemical Company and Charles Lennig & Company.

PLEXIGLAS *is the trade-mark, Reg. U.S. Pat. Off., for the acrylic resin thermoplastic sheets, rods and molding powders manufactured by Rohm & Haas Company.*

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Manufacturers of Chemicals including Plastics . . . Synthetic Insecticides . . . Fungicides . . . Enzymes . . . Chemicals for the Leather, Textile and other Industries

IF YOU ARE IN A *Tight Spot* . . . TRY NIXON

When they have you on the mat to meet a delivery date on important uses and you need help . . . call on NIXON. We do not have a roll of red tape in the place . . . No waiting for a decision. Get in touch with NIXON today.

NIXON *Plastics*

MATERIALS: Cellulose Acetate • Cellulose Nitrate • Ethyl Cellulose
AVAILABILITY: Sheets • Rods • Tubes • Extruded Profiles
Cellulose Acetate and Ethyl Cellulose Molding Powder

NIXON NITRATION WORKS • NIXON, NEW JERSEY

M. FAHRINGER
1635 West Farwell Ave.
Chicago, Ill.

C. D. KERR, JR.
5600 Bedford Road
Detroit, Mich.

A. F. PERRY
Leominster
Mass.

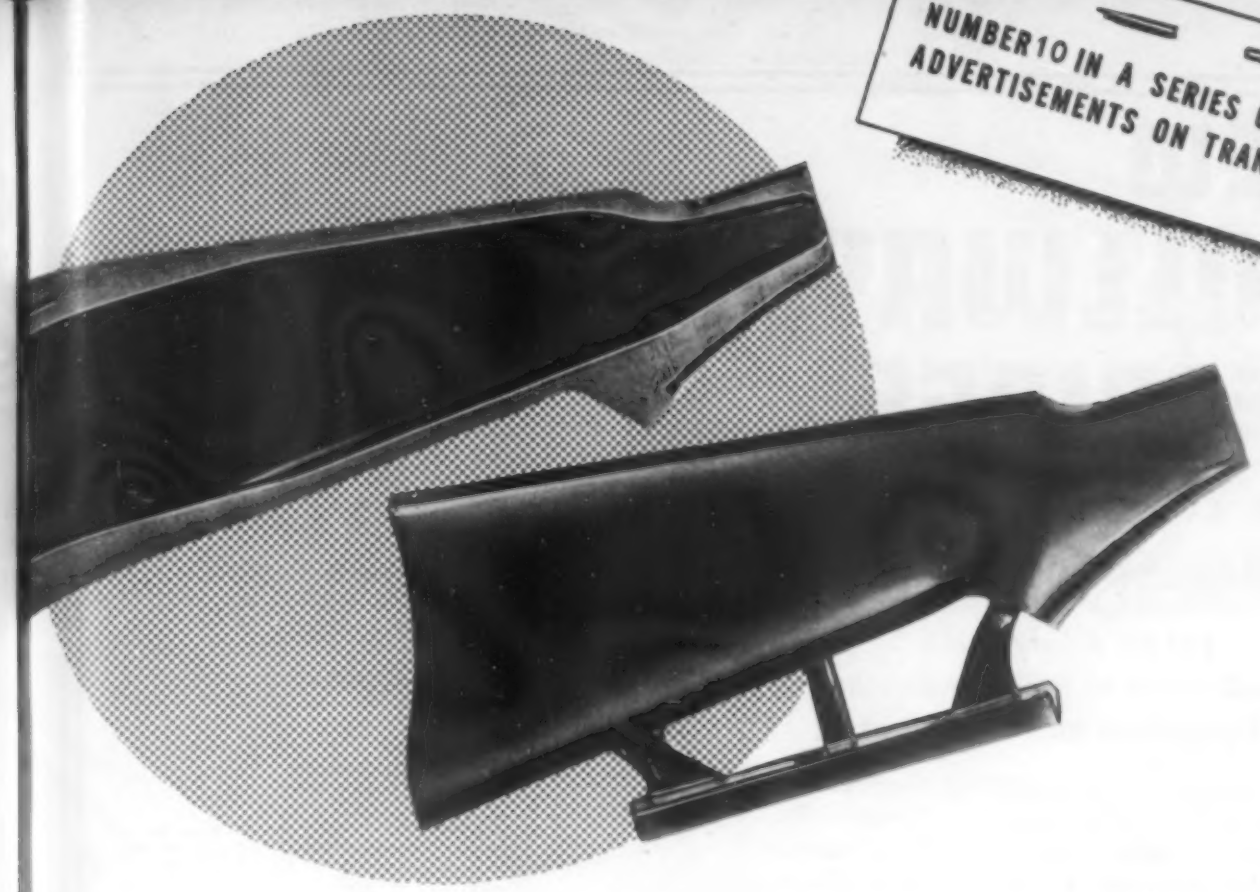
W. S. MOWRY
126 Marsdon St.
Springfield, Mass.

C. B. JUDD
401 Loudermann Bldg.
St. Louis, Mo.

NORTHWEST PLASTICS INDUSTRIES
921 Terminal Sales Bldg.
Portland, Ore.
415 Fourth Cherry Bldg.
Seattle, Washington

HOBBS GLASS, LTD., *Canadian Distributors*—Quebec • Montreal • Ottawa • Toronto • Hamilton
Brantford • London • Windsor • Winnipeg • Moose Jaw • Saskatoon • Vancouver • Victoria

NUMBER 10 IN A SERIES OF EDUCATIONAL ADVERTISEMENTS ON TRANSFER MOLDING



LARGE HOLLOW MOLDINGS

The cross-sectional illustration of the gun-stock made by TRANSFER MOLDING shows how this process can turn out the largest pieces with cavities running throughout their entire lengths. The finished job is strong since there are no weld marks. Cure is uniform throughout; and the material reaches every crevice of the mold to form a plastic part free from internal flaws.

There is no other process that can give the sure precision of TRANSFER and none other to mold such large, unsupported cores in thermosetting plastics.

These are reasons why TRANSFER MOLDING is being done by more and more molding plants throughout the country.

TRANSFER MOLDING *is the best way to*

Handle inserts—metal, glass, ceramic
Mold high-impact materials
Mold unsupported cores
Achieve maximum dimensional accuracy
Reduce trapped gases
Lower mold costs
Lengthen mold life
Increase molding speed
Reduce finishing costs
Improve uniformity of cure regardless of cross-section
Save material by eliminating flash
Get practical solution to difficult molding problems

—on thermosetting plastics.

SHAW INSULATOR CO.

IRVINGTON SHAW NEW JERSEY

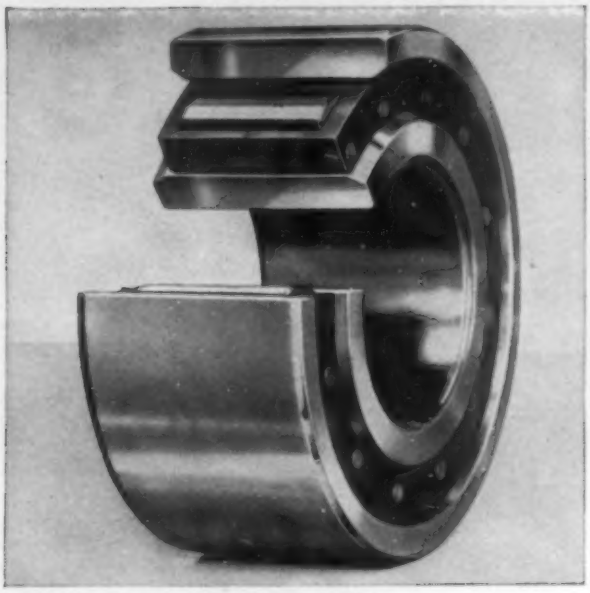
NEW ROLLWAY BEARINGS

Earn 20 Times Their Investment Cost Annually

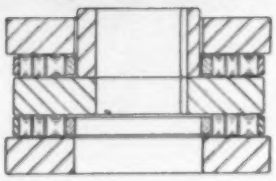
Let Us Analyze the Possibilities of Rollway Bearing Equipment in YOUR Plant

Think of it—just four Rollway bearings (two Couch Roll bearings and two Pressure Roll bearings) actually earned $250.00 per day or $75,000.00 per year for one plant. And when we say earned, we mean increased production that yielded a $75,000.00 gain in annual profit. *More than 20 times the cost of the bearings,* to say nothing of an average saving of 31 horsepower.

We don't say that every plant can show comparable gains simply by installing Rollway bearings, but we do believe that Rollway's right-angle loading of bearings will give the average plant:



Type CS Double Width Radial



Type DT Double Acting Thrust

1. **Marked increase in bearing life.**
2. **Marked improvement in the speed-load-life ratio of bearings.**
3. **Marked decrease in bearing replacements, shaft wear and maintenance time.**

For compound loads, diagram shows how SEPARATE radial and thrust bearings are used in combination:

- All radial loads carried at right angles to the roller axis.
- All thrust loads carried at right angles to the roller axis.

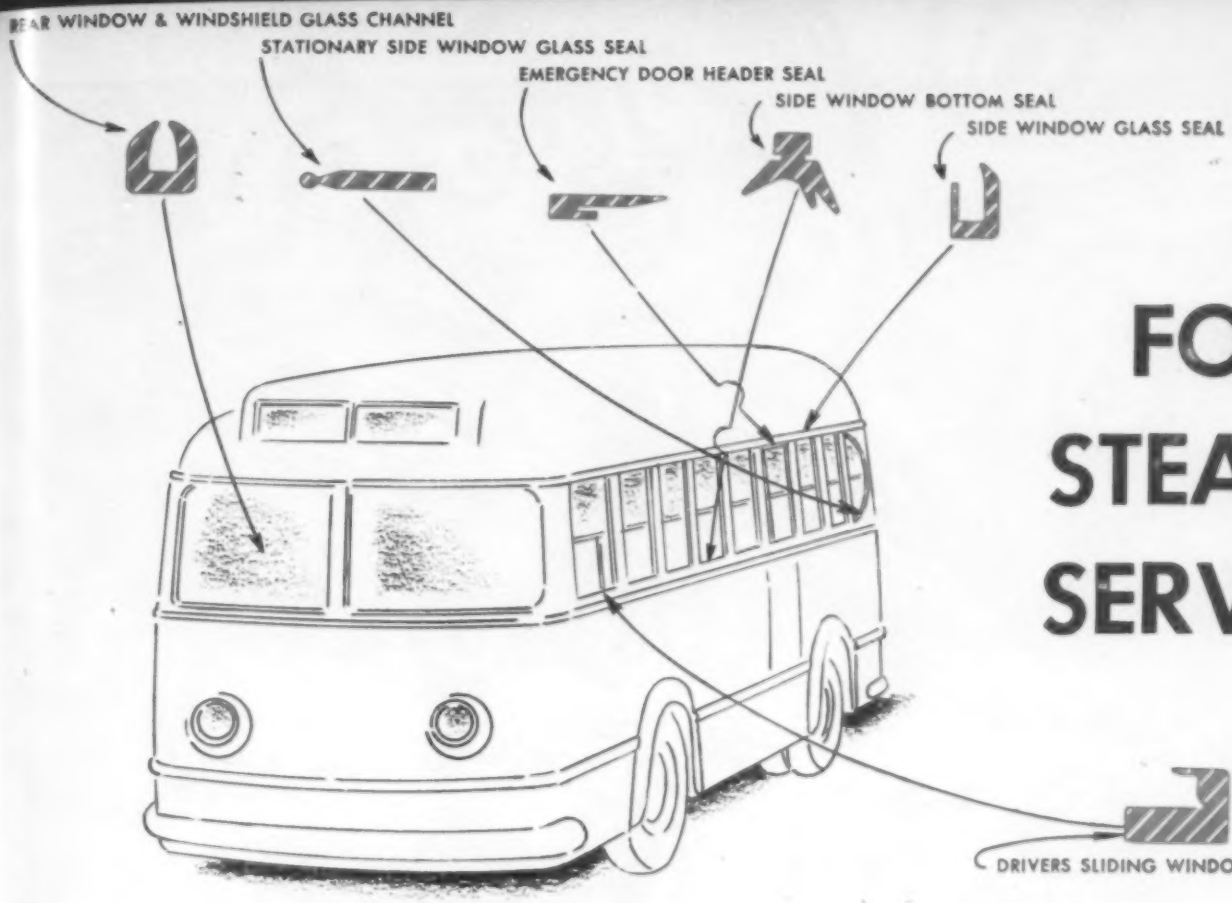
Simplifies the Load...

Rollway's right-angle loading splits the load into its two simple components of pure radial and pure thrust—each carried by a separate roller assembly. It eliminates all compound loads, all oblique loads and resultants, insuring greater load capacity in any given dimensional limit. There's no pinching effect to force rollers out from between the races, hence less roller-end wear-back and less rubbing or sliding friction. Starting and running torques are both lower; power consumption goes down.

Write today; let a Rollway engineer make a free bearing analysis of your plant; let us estimate the savings or earnings you might reasonably expect from Rollway's Right-Angle Loading.

ROLLWAY BEARING COMPANY, INC., SYRACUSE, NEW YORK

BUILDING HEAVY-DUTY BEARINGS SINCE 1908 **BEARINGS**


REAR WINDOW & WINDSHIELD GLASS CHANNEL
STATIONARY SIDE WINDOW GLASS SEAL
EMERGENCY DOOR HEADER SEAL
SIDE WINDOW BOTTOM SEAL
SIDE WINDOW GLASS SEAL
DRIVERS SLIDING WINDOW GLASS SEAL

FOR STEADY SERVICE

MACOID EXTRUSIONS

Other examples of MACOID extruder elastomeric plastics in our special Vinyl compound, MACOID 320, are these applications on the Dearborn Coach Company's bus.

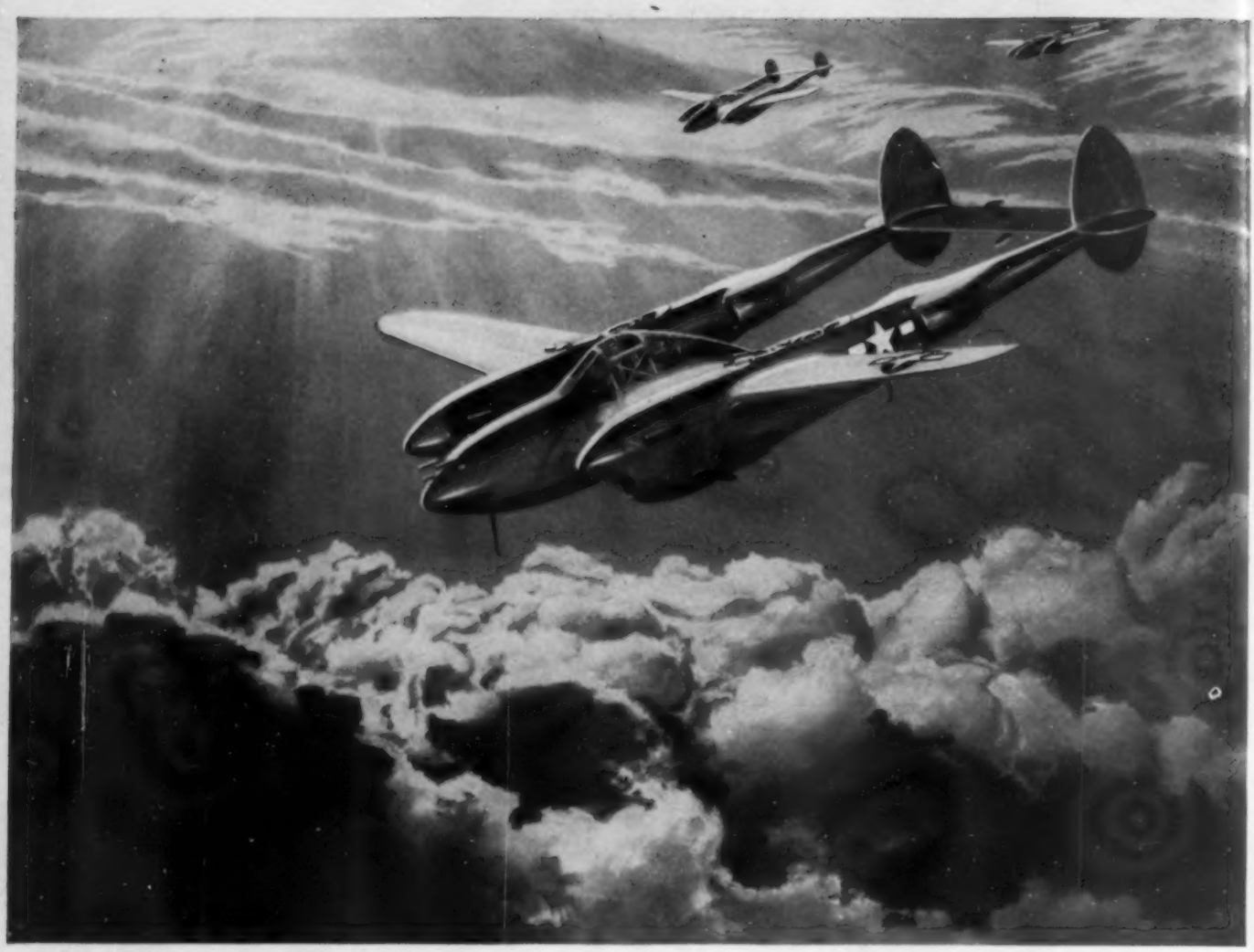
MACOID 320 has the feel of rubber, but is much superior to the natural product in resistance to oil, greases, gasoline, acids, alkalies, etc. Profiles are extruded to specification of body manufacturer, Union City Body Co.

So satisfactory is this material that many automotive designers are specifying it for their postwar models, even should natural rubber be available.

As originators of modern dry plastics extrusion, MACOID has been privileged to initiate many applications of the process, and to develop special formulations of materials. We will be glad to serve your requirements with special profiles and materials whether you are in the automotive field or the other fields we serve. We also do injection molding.

DETROIT MACOID CORPORATION
12340 Cloverdale Ave.
Detroit, Michigan

ORIGINATORS OF DRY PROCESS PLASTIC EXTRUSION



FINGER-TIP CONTROL FOR SPEED FASTER THAN SOUND

When an Army Air Forces officer power-dived the Lockheed *P-38* faster than the speed of sound (780 m.p.h.), he proved that the plane was appropriately named *"Lightning"*.

Now Lockheed engineers have given "finger-tip control" to its fantastic speed by installing aileron boosters actuated by the revolutionary Hycon "Stratopower" hydraulic pump. The application of these boosters, made practical for the first time, turns the *P-38* into a *dog-fighter which out-maneuvers many single-engined ships!* And the faster response of *all* control surfaces makes it a deadly fighter—even in the thin air eight miles up.

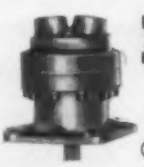
To help bring victory in 1944, we are increasing our output to the limit, and every Hycon "Stratopower" pump is reserved for our fighting planes.

LET'S ALL BACK THE ATTACK — BUY MORE WAR BONDS

At the war's end—for Tomorrow

Because of its compactness and phenomenally high pressure, furnishing *variable volume up to 3000 pounds per square inch*, the Hycon "Stratopower" pump will do a great many hydraulic jobs *better*.

Today there are available other Hycon pumps and valves in the 3000 pound range for commercial applications to control or actuate machine tools, giant presses, dump truck lifts, materials-handling mechanisms and remote control circuits. They will operate brakes, clutches and steering devices of heavy vehicles; test high-pressure apparatus, and solve a wide variety of other hydraulic problems. Write for full information.



HYCON ★ ★ ★

REGISTERED TRADE MARK

Stratopower Pump

THE NEW YORK AIR BRAKE COMPANY

Hydraulic Division

420 LEXINGTON AVENUE, NEW YORK 17, N. Y.

NORTON LABORATORIES (INCORPORATED)
CUSTOM MOULDERS OF SYNTHETIC PLASTICS
BAKELITE DUREZ
LOCKPORT, N.Y.

NORLOC NOVELTIES

ALL AGREEMENTS ARE CONTINGENT UPON STRIKES, FIRES, ACCIDENTS OR CAUSES BEYOND OUR CONTROL.
CONTRACTS WITH AGENTS NOT VALID UNTIL APPROVED BY AN OFFICER

April, 1943

Dear Customers and would-be customers:

Sounds as if we were hard to get, doesn't it? Why should anybody be anxious to become a customer of ours? Probably because some other molder is busy and they need some work done.

We've no illusions about our ability. Although some of our customers do seem to have illusions about our high standards of quality molding. And why should we try to disillusion them? We kid them along a little, do the best kind of molding we know how and somehow they seem to stay satisfied. At least they keep coming back for more moldings, which is the best test we know of, in business.

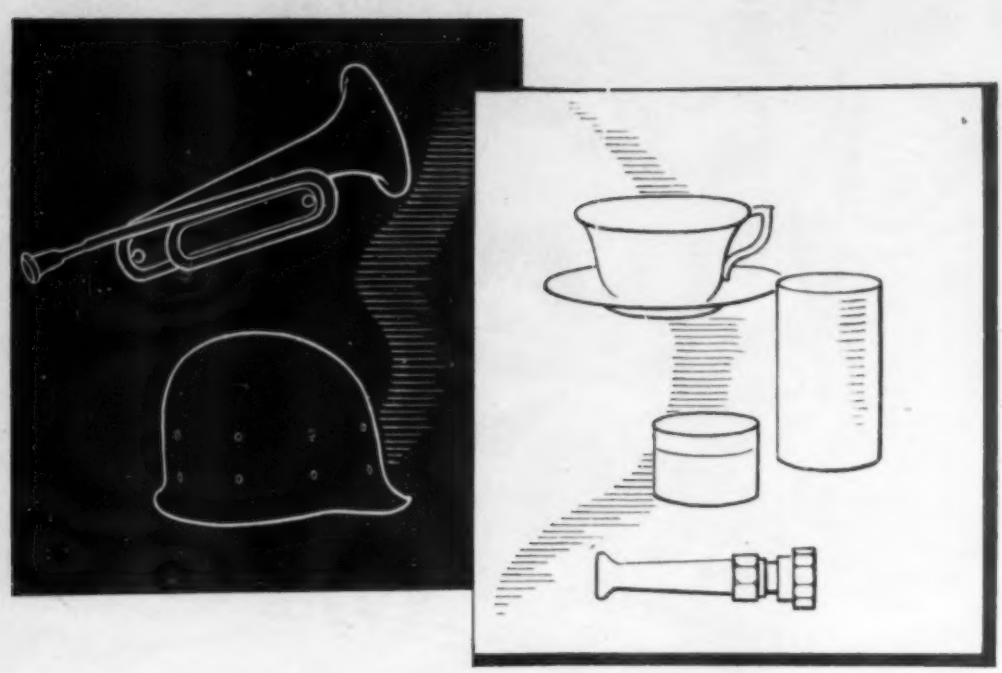
We're not the best molder in the business. We don't know if we could pick one and say that he's best. We don't envy these purchasing agents who have to dole out work to 37 or 59 molders. We'd be confused, too, if we had to do that.

All we can say is we do <u>our</u> best and it seems to be good enough for some tough Government jobs in wartime and some very fussy firms in peacetime.

I'll write you again next month.

Sincerely,

H. G. Valentine
Sales Manager



Warfare TO Welfare!

HYDRAULICS Rodgers KEEP THE WORLD MOVING

Manufacturers of:

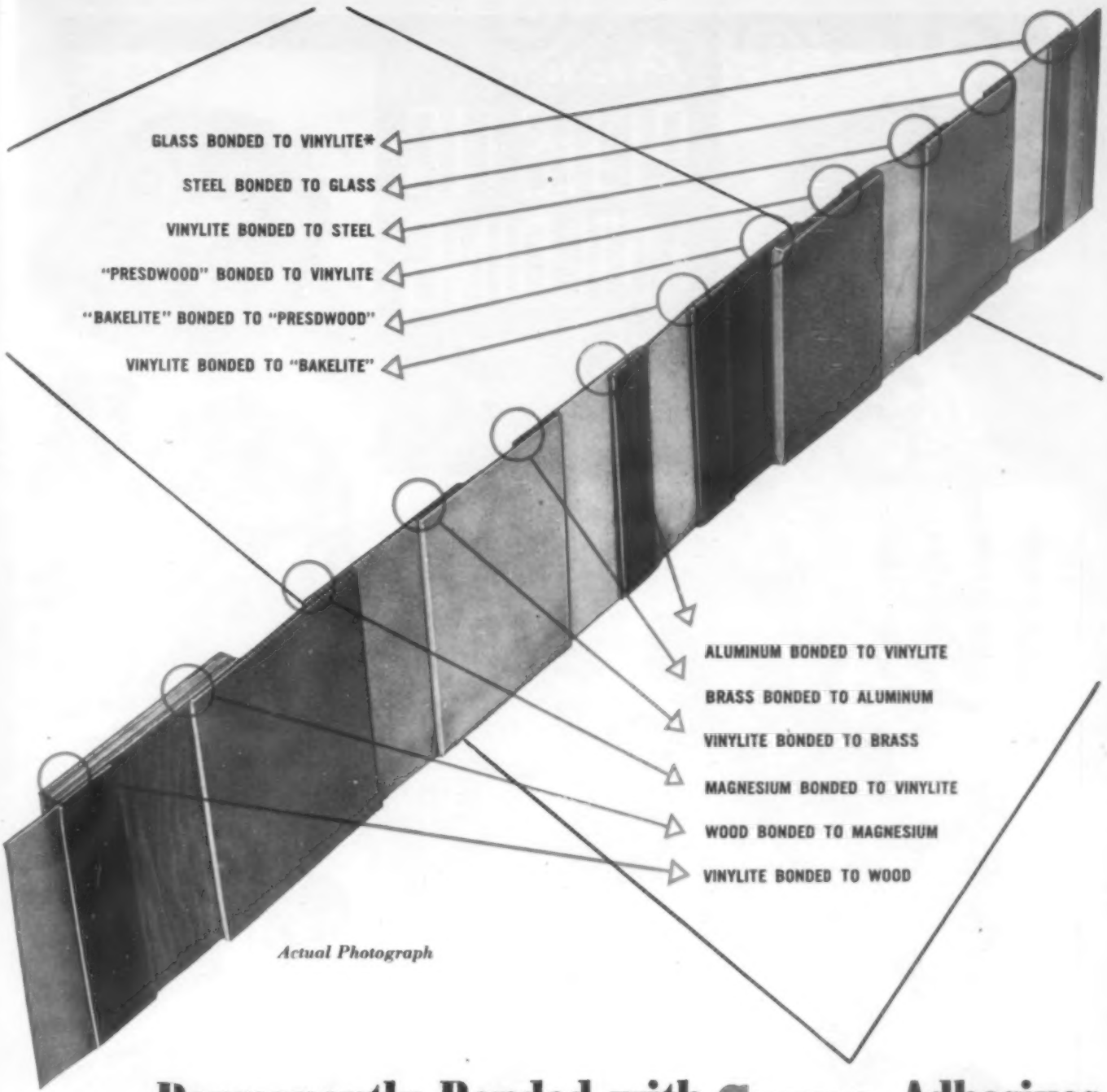
HYDRAULIC PLASTIC PRESSES
UNIVERSAL HYDRAULIC PRESSES
HYDRAULIC KEEL BENDERS
POWER TRACK WRENCHES
TRACK PRESS EQUIPMENT
HYDROSTATIC TEST UNITS
PORTABLE STRAIGHTENER FOR PIPE AND KELLYS

As we said last month, plastics are "on the march." Everywhere on our warring fronts the use of this modern material in all its various forms has contributed greatly toward the efficiency and comfort of our armed forces on land and sea.

As manufacturers of Rodgers Hydraulic Plastic Presses, we have more than a passing interest in all this essential activity, although at the moment our energies are given entirely to war work. After the war we know that the skill and the inventiveness of this great plastics industry will turn to the manufacture of thousands of products and articles for human Welfare. At that time we will have important announcements of developments in Rodgers Plastic Molding equipment. We hope that time will be soon.

If it's a Rodgers . . . it's the best in Hydraulics. Rodgers Hydraulic Inc., St. Louis Park, Minneapolis, 16, Minnesota.

Rodgers HYDRAULIC Inc.


GLASS BONDED TO VINYLITE*
STEEL BONDED TO GLASS
VINYLITE BONDED TO STEEL
"PRESDWOOD" BONDED TO VINYLITE
"BAKELITE" BONDED TO "PRESDWOOD"
VINYLITE BONDED TO "BAKELITE"
ALUMINUM BONDED TO VINYLITE
BRASS BONDED TO ALUMINUM
VINYLITE BONDED TO BRASS
MAGNESIUM BONDED TO VINYLITE
WOOD BONDED TO MAGNESIUM
VINYLITE BONDED TO WOOD

Actual Photograph

Permanently Bonded with CORDO Adhesives

A constantly increasing range of materials is being bonded successfully with CORDO Adhesives. Plastics, glass, wood, metals—rigid or flexible—to each other and to one another.

Strengths attained approach closely and, in some combinations, equal or exceed the strengths of the materials being bonded.

CORDO Adhesives were created and developed to satisfy specific bonding applications. Perhaps the CORDO Research Laboratories can help solve some of your present or post-war bonding problems.

Please write, giving all essential details: bond strengths necessary, service requirements, materials to be used, pressure and baking methods available.

* VINYLITE IS THE REGISTERED TRADE MARK OF CARBIDE AND CARBON CHEMICALS CORPORATION

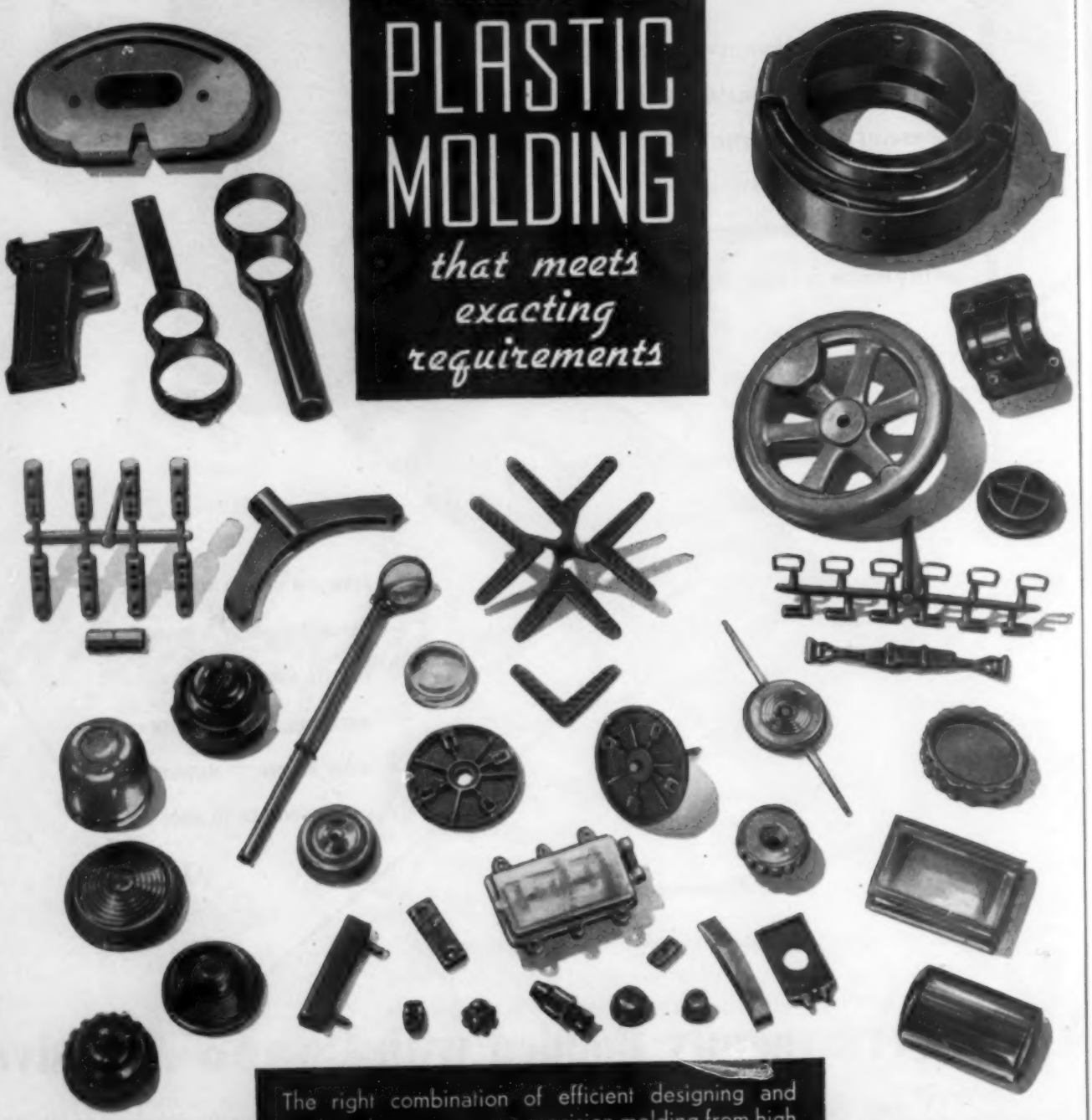
CORDO CHEMICAL CORPORATION
(*Formerly* CORROSION CONTROL CORPORATION)
34 Smith Street, Norwalk, Connecticut
INDUSTRIAL COATINGS • FINISHES • INDUSTRIAL ADHESIVES

CORDO

Precision

PLASTIC MOLDING

that meets exacting requirements



The right combination of efficient designing and engineering assures you precision molding from high quality thermoplastic materials. Your exacting requirements are met promptly, efficiently and accurately, from small intricate designs to large 18 oz. moldings. Complete complementary equipment to answer your demand for plastic moldings, including complete dash panels, garnish moldings and similar trim.

Due to the allocation control of plastic materials, our production is at present restricted to direct war and essential civilian work.

Main Office and Plant
Este Ave. and Orient St.
Cincinnati, Ohio

Branch Plant — Sales Office
Richmond, Indiana

Sales Office
Detroit, Mich.

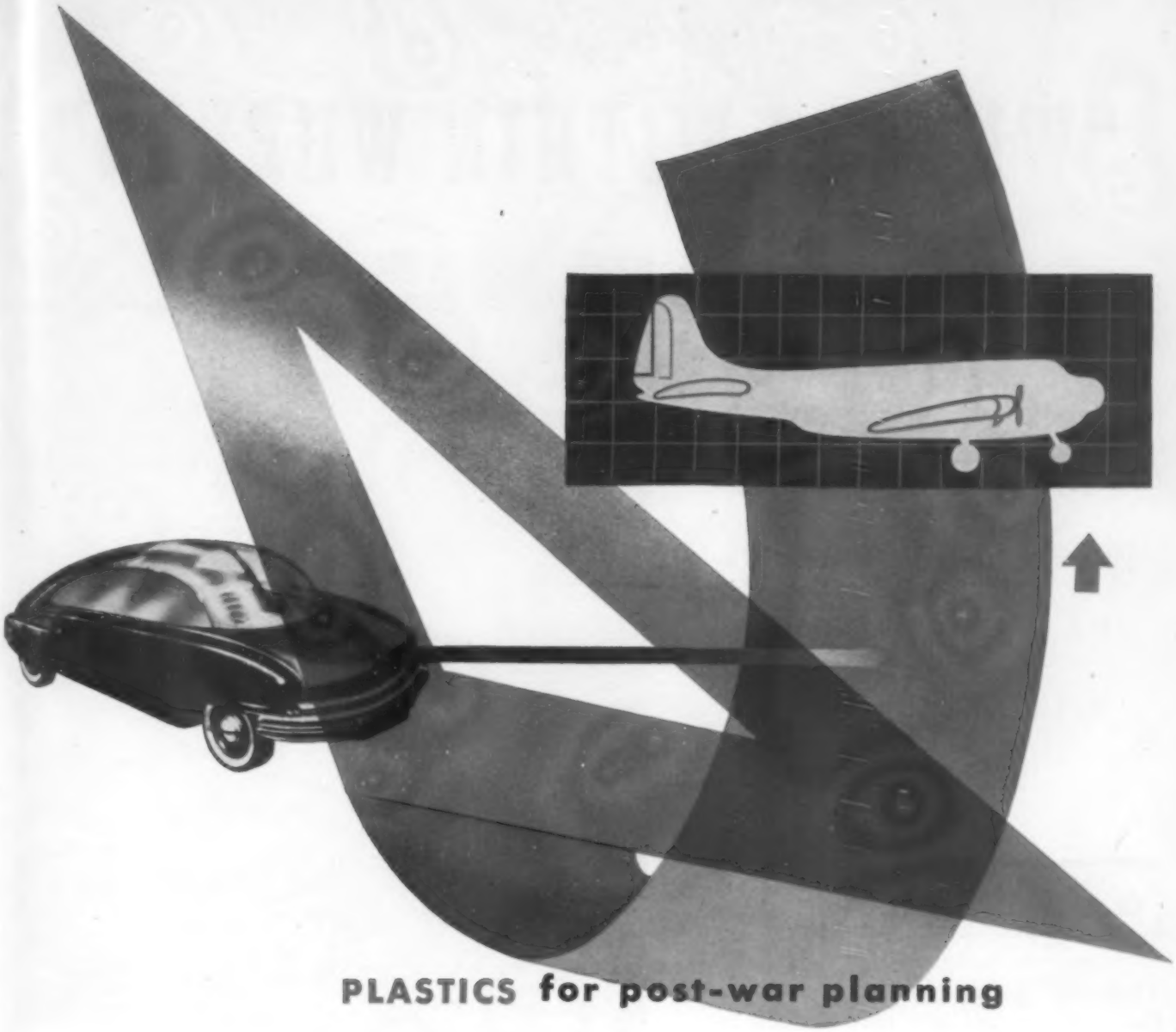
Buy WAR BONDS

ARMY E 1st NAVY

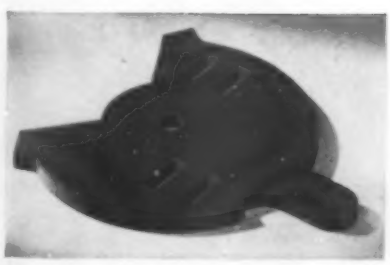
The METAL SPECIALTY *Co.*

MAIN OFFICE AND PLANT • ESTE AVENUE • CINCINNATI OHIO

PLASTIC DIVISION



PLASTICS for post-war planning



"Cat's head," they call it. The core is Phenol Fibre—to eliminate moisture absorption and to increase dielectric strength. But because an electric arc will not carbonize Vulcanized Fibre, the front and back of the Cat's head are made of Vulcanized Fibre.

While there is still a war to be won, your principal concern, as well as ours, is to produce products that will speed victory. We are all giving our maximum attention and production-capacity to that vitally important objective.

But even the most pessimistic will agree that it is not too soon to *plan* and *think* for the post-war reconstruction period. Peace will dawn with the suddenness of a raised curtain and only those who are prepared for it will be able to swing into profitable, peace-time production with the minimum delay.

Figuring prominently in many a *profitable*, peace-time venture will be the intelligent use of Vulcanized Fibre and Phenol Fibre. In the design, application, and production of such products, Taylor Fibre is unsurpassed, thanks to Taylor's Verifibre Process in which quality is controlled step by step, from raw materials to finished product, in the industry's most modern plant.

Now—before the curtain goes up on a bright, new world, discuss your post-war plans with our engineers. *Now* is the time to Take it to Taylor.

TAYLOR FIBRE COMPANY

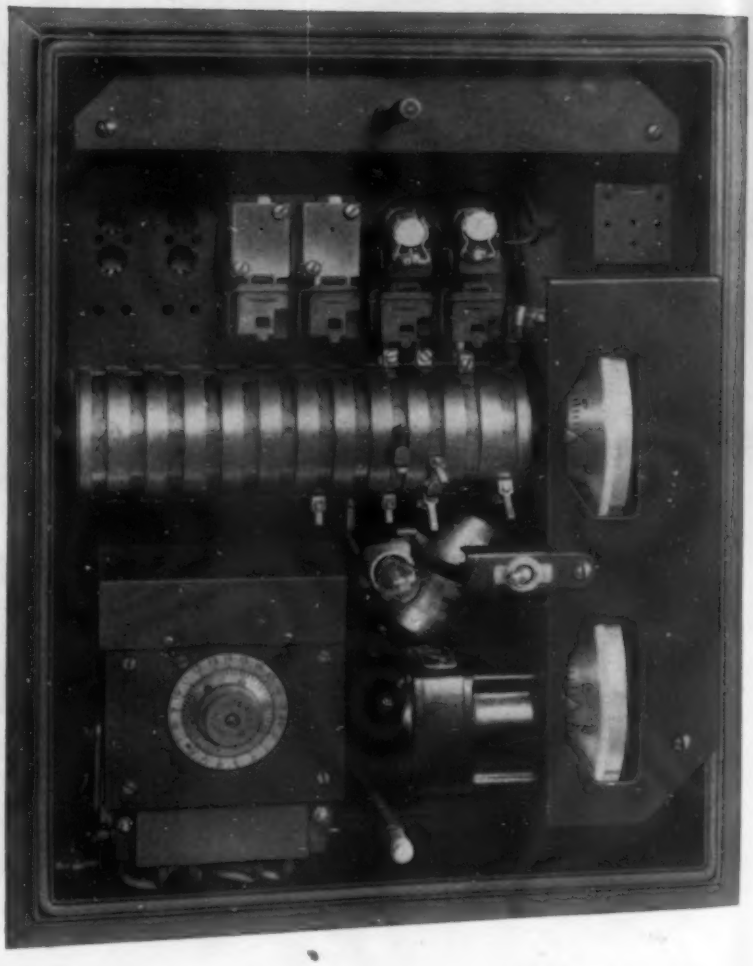
NORRISTOWN, PENNSYLVANIA • OFFICES IN PRINCIPAL CITIES • PACIFIC COAST HEADQUARTERS: 544 S. SAN PEDRO STREET, LOS ANGELES

LAMINATED PLASTICS: VULCANIZED FIBRE • PHENOL FIBRE • SHEETS, RODS, TUBES, and FABRICATED PARTS

Taylor presents

"WHEELS WITHIN WHEELS"

A TIMER WITHIN A TIMER— TO ENABLE YOU TO CHANGE ANY CURE PERIOD SIMPLY— WITHOUT COMPLICATED RE-SETTINGS



When it comes to automatic platen press operation, we thought our Taylor Flex-O-Timer was the last word in adaptability. But now our engineers have made it even more versatile.

What they've done is install a small auxiliary timing mechanism in the lower left corner of the Taylor Flex-O-Timer instrument case. The Flex-O-Timer initiates and terminates all necessary process functions, while the auxiliary timer times the cure period only. So when you want to change the cure period, you can do it with just one simple dial adjustment, without touching any of the settings on the Flex-O-Timer itself.

Simple, isn't it? It really *is* simple, and your Taylor Field Engineer is anxious to show you how it can help you improve quality and cut costs. All you do is load the press and push the button—Taylor Accuracy does the rest! Taylor Instrument Companies, Rochester, N.Y., and Toronto, Canada.

Instruments for indicating, recording, and controlling temperature, pressure, humidity, flow, and liquid level.

ARMY E NAVY

Taylor Instruments

MEAN

ACCURACY FIRST

IN HOME AND INDUSTRY

KEEP ON BUYING U. S. WAR BONDS AND STAMPS

Pencil test proves uniform heating

WITH -MEGATHERM- DIELECTRIC HEAT

The 4" diameter preform shown was made in a 75 ton press and heated to full molding temperature in 30 seconds with the popular 3 KW Megatherm.

Federal Industrial Power Tubes, built with the ultimate of care and workmanship, give power and performance to Megatherm and other industrial heating equipment.

Right at the point of your pencil is proof that Federal's Megatherm produces absolutely *uniform* preheating . . . a slight pressure and the pencil pushes right through the preform!

Megatherm's High Frequency Heat achieves this homogeneous plastic state in *seconds!* And that's not all . . .

As a result *mold pressures are drastically reduced*—since the uniformly heated material flows more easily. This means less stress on die inserts and no internal stress in the form when curing cycle is completed. Thus you can do precision molding, free of porosity, with lighter equipment. And you can reduce curing time from minutes to seconds, double or triple production, and eliminate warping and cracking — even on compression molding of thick sections!

Megatherm arrives at your plant ready to go to work and requires no skill to operate, no change in plant layout.

Get the full story today from Federal—the world famous name that is synonymous with industrial electronic progress.

Federal Telephone and Radio Corporation

INDUSTRIAL ELECTRONICS PRODUCT DIVISION — An IT&T Associate — Newark 1, N. J.

IN THE LIGHT OF GREATER EXPERIENCE

Hobbing the cavity shown above is much less a problem to us today than it would have been just a few years ago. The courage to undertake the untried has given this group at Midland the experience and skill to accomplish the unusual and difficult. As a result, a growing number of plastic molders and die makers have learned to rely on Midland for hobbed cavities, and to send such work to us as a matter of insuring complete satisfaction.

Have you sent us your request for a copy of "Shaping Tomorrow Today"? It contains much interesting information on plastic molds, dies and hobbed cavities. Write today!

D&E

MIDLAND DIE AND ENGRAVING COMPANY

1800 W. BERENICE AVENUE . . . CHICAGO 13, ILLINOIS

Makers of Plastic Molds • Die Cast Molds • Engraved Dies • Steel Stamps • Hobbings • Pantograph Engraving

FOR UNIFORM PREHEATING OF LARGE PREFORMS

USE THIS NEW RCA 15-KW ELECTRONIC HEATER

WITH electronic heat you can heat preforms weighing several pounds quickly and evenly—producing uniform plasticity throughout the entire preform simultaneously. Press output can be materially increased as a result. With the new RCA 15-Kw generator the temperature of 7½ pounds of preformed material can be raised from 70° to 275° F in about 60 seconds!

Additional Advantages: This completely uniform plasticity means faster press closing; shorter curing time; less mold damage; lower mold pressure; complete flow into intricate molds; elimination of internal stresses due to uneven heating; and freedom from warping in final product. Rejects are materially reduced when electronic preheating is used.

How It Works: The principle of heating plastic materials with electronically generated power is simple. Standard 60-cycle electric power is converted by means of electron tubes to high-frequency electric power (up to 10,000,000 cycles per second). This power is fed to two metal plates between which the plastic material is placed. At such high frequencies, the electricity "passes through" the plastic, causing molecular friction, which results in heat. The heating rate at the center is the same as at the outside.

Easy Operation: The RCA 15-B is simple to operate. Adjustments are easily made, and once they are made, any intelligent operator can use the equipment with complete ease. Remote push-button control is provided. The generator is compact, and styled for industrial application.

Write today for further details, or for specific information on applying electronic heat to your production. Address RADIO CORPORATION OF AMERICA, Electronic Apparatus Section (70-34), Camden, New Jersey.

RCA

RCA ELECTRONIC HEAT

RADIO CORPORATION OF AMERICA

FREE

BUY WAR BONDS

RCA, Electronic Apparatus Section, Camden, N. J.

Please send me details on the new RCA 15-B electronic generator; also send "R-F Heating Speeds Plastic Molding."

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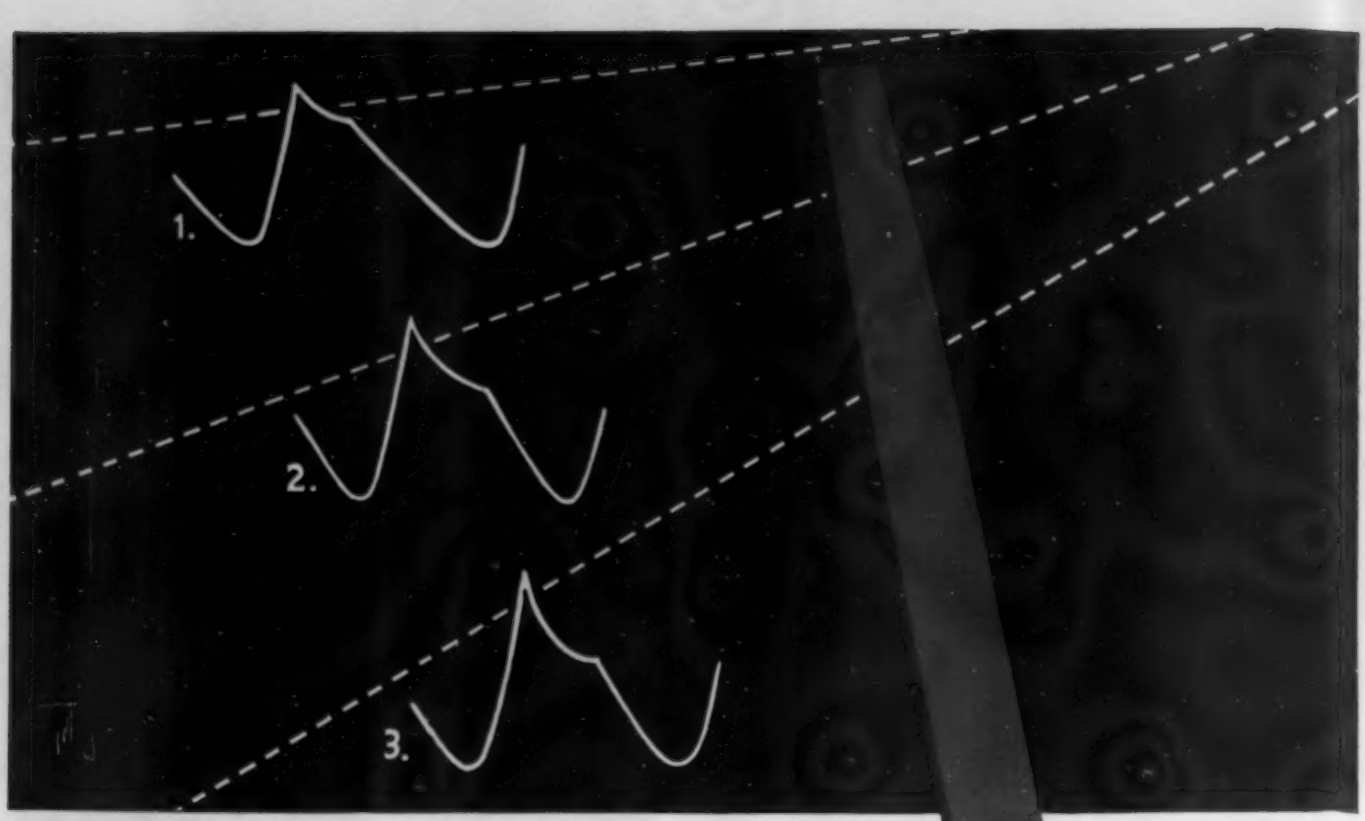

Note the differences in "cutting zones" in these three types of file teeth:

1. **FOUNDRY FILE** — stubby teeth with short cutting top.
2. **ORDINARY MILL OR FLAT BASTARD FILE** — medium-topped teeth.
3. **FILES FOR PLASTICS** — thin-topped teeth (as required on most operations and types of material).

SOME POINTS ABOUT FILE TEETH POINTS

Because of the hardness and density of the type of plastic material required for his products, a manufacturer of gears, bearings and work helmets found difficulty in flash removal, beveling, smoothing edges and corners . . . and also in preventing early wear-out of the files used.

Nicholson's study of plastics filing quickly led to the solution. The mistake lay in using double-cut files. They clogged easily because of the narrow spaced teeth; produced a scratchy finish; and, because of the high abrasive action of the material, the short cutting top of the teeth was soon gone.

In this particular case, the Nicholson Western Cut File for Plastics was recommended as the proper substitute. Its single-cut teeth provided the needed smoothing effect; their wide gullets minimized clogging; their long, thin tops enabled fast cutting and, while wearing down, continued to retain a serviceable cutting edge. Immediately, finishing results improved, filing production rose, tool costs dropped.

Name the job and we'll name the file

Many combinations of material, product design and forming processes present their own peculiar finishing problems — which, more likely than not, can be solved by selecting *The right file for the job.* Nicholson engineers will gladly study any such problems, and make file recommendations. Contact us direct or through your mill-supply house.

FREE BOOK, *"FILE FILOSOPHY,"* on kinds, use and care of files—48 illustrated pages of interest to production and purchasing heads, foremen, mold and die makers.

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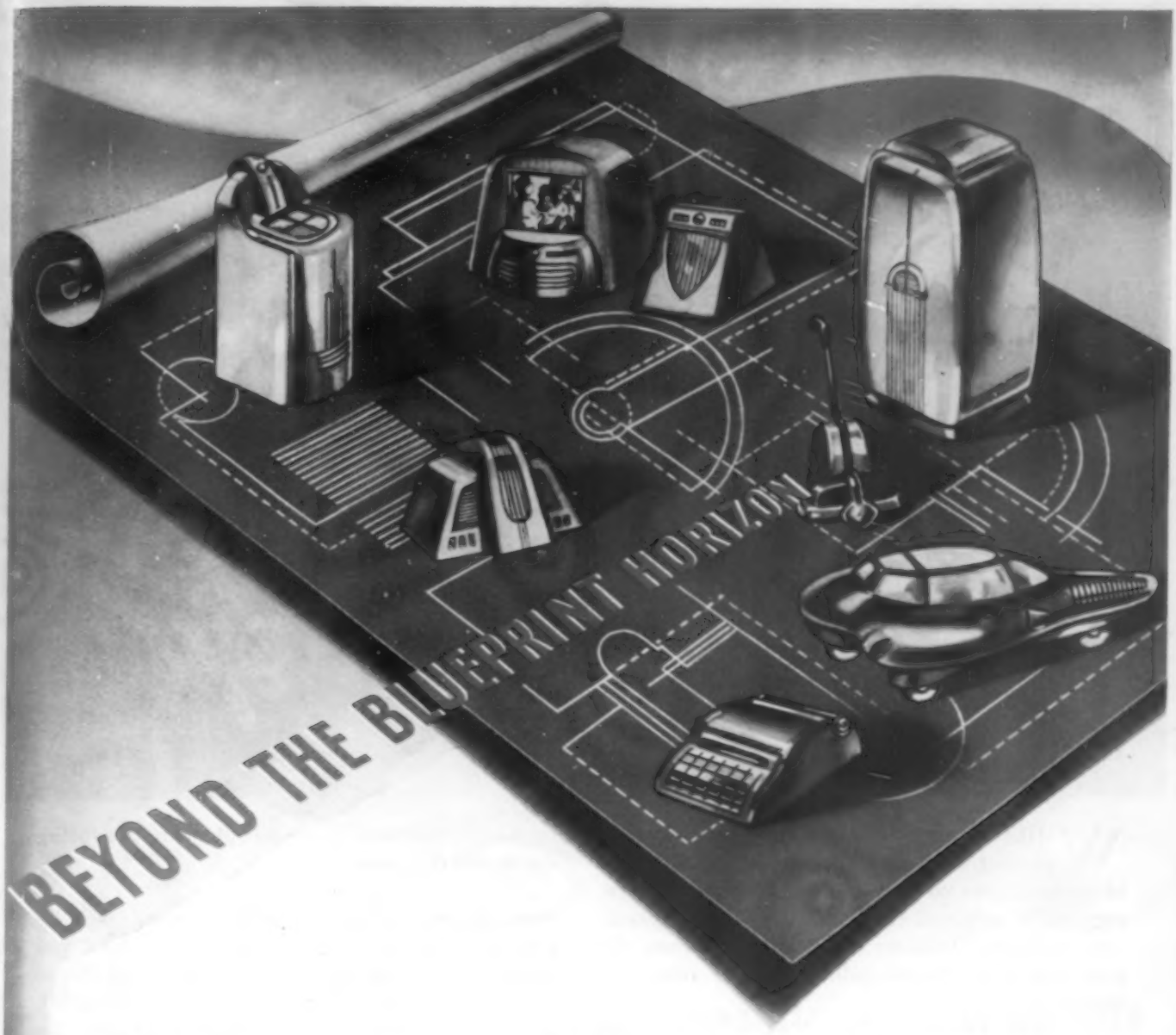
NICHOLSON FILES FOR EVERY PURPOSE NICHOLSON U.S.A.



Planning beyond Tomorrow—when Victory will release our present efforts to Peace-time products—Planning to meet many new problems—new Visions—new Ideas—new Products . . . and new Materials with which to build them. You will find RESIN FIBRE PLASTICS importantly significant when your Blueprints begin to materialize.

Some products of the future are as yet indefinite—But RESIN FIBRE PLASTICS already have the definite factors necessary for successful production of present as well as future Products. Within the scope of the amazing development of RESIN FIBRE PLASTICS are its diversified Applications . . . pliability of formulation . . . high physical property values . . . the solution of difficult contours . . . the factor of economy . . . large sizes . . . All potentialities for solving the difficult problems, Structurally and Productionally.

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RESIN FIBRE PLASTICS

LICENSING MANUFACTURERS

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U. S. Army's Heavy 60-ton tank
Photo by U. S. Army Signal Corps

WHILE it would be a mistake to put aside important war work, yet even as with the governments of our country and our allies, it is necessary NOW to spend some time on post-war plans and products. Industry must be ready when the time comes to absorb millions of our returning heroes.

What is the status of YOUR post-war plans? ARE YOU READY..will you be among the first to hit the market between the eyes with a product that fits the future? Will YOU survive the *new* competition in *your* field, created by the reconversion of vast war plants to producing the products of peace.

Sinko plastic engineers are eminently fitted with ingenuity, skill and long experience to lend you effective aid in applying all the beauty, color, and strength of economical THERMOPLASTICS to your products. Let them study your post-war plans.. help you NOW through the drawing board stage. Be ready to act quickly ..to get the jump on competition the moment we get the signal to GO AHEAD!

INJECTION MOLDED Sinko PLASTICS

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Ready ahead of time—the Sav-Way MH-1 combination hand and electro-hydraulic internal grinder. 5/32″ minimum table stroke! Gatling gun table speed, through the use of aircraft-type micro-limit switches and solenoid-operated valves. Electrical, automatic, adjustable cross feed. Dozens of outstanding features! As up-to-the minute as the plastics industry, itself! It's a postwar machine—ready now to help speed today's war production! Its low cost will surprise you.

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BUILDERS OF HAND AND HYDRAULIC INTERNAL GRINDERS • PRODUCERS OF GOLD SEAL SPINDLES
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in a single year PLYOPHEN forges to the front!

● Less than a year ago, RCI announced that—"the unequalled resin-making equipment and facilities of America's leading manufacturer of synthetic resins are now being applied to the development and production of liquid phenolic laminating resins and varnishes."

Today, the value of this program and the worth of the products are attested by a volume and range of uses far exceeding all expectations!

Two dominant reasons explain this quick success—the high and uniform quality resulting from RCI's advanced production methods, and the proven ability of RCI to deliver in quantity and on time.

The Plyophen line already includes varnishes meeting the severest mechanical and electrical tests . . . varnishes for low-pressure molding with high-strength paper, canvas and other fibrous materials . . . liquid resins for wood bonding, fibre glass insulation, or applications requiring extreme water resistance—and new types are constantly being produced.

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DEAD MAN'S REMOTE CONTROL

Erie Resistor PLASTICS

ERIE Resistor's Engineering skill and ingenuity, as well as their experienced molding technique are reflected in the plastic, "Dead Man's Remote Control Grip" for heavy calibre aircraft guns. As shown in the photograph of the cut-away section of the grip, an intricate coring job was involved, but by the proper designing of dies, the grip was produced in one operation, and an extremely fast molding cycle was attained.

The grip is molded of cellulose acetate butyrate to very close tolerances, thereby combining the necessary mechanical strength with the precise dimensional accuracy required to accommodate the electrical switches and wire leads.

This Remote Control Grip is only one of hundreds of molded plastic articles turned out by the Plastics Division of Erie Resistor, and it exemplifies the standards of precision, mechanical strength, and production speed obtainable where sound engineering, experienced molding technique, and adequate facilities are available.

Write for our new illustrated Bulletin.

ARMY E NAVY

FOR HIGH ACHIEVEMENT IN WAR PRODUCTION

Let's All Back The Attack **BUY WAR BONDS**

ER *Plastics Division* ER

ERIE RESISTOR CORPORATION, ERIE, PA.

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CAUTION IN PRODUCTION

Success in tackling something new requires a mixture of boldness and caution.

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The caution is never relaxed. Even those products we've been making for 100 years are still watched over by constant laboratory control from raw product to shipping platform. We believe that only through such integrity in manufacturing can quality standards be built and maintained.

In planning for new products, or betterment of present ones, consultation with our laboratory engineers will bring to your problem the advantage of our long experience in the production and use of fatty acids and their derivatives. In selecting any Emery product, you have the assurance that it will perform as specified.

**Only laboratory samples of Azelaic and Pelargonic Acids are available now.*

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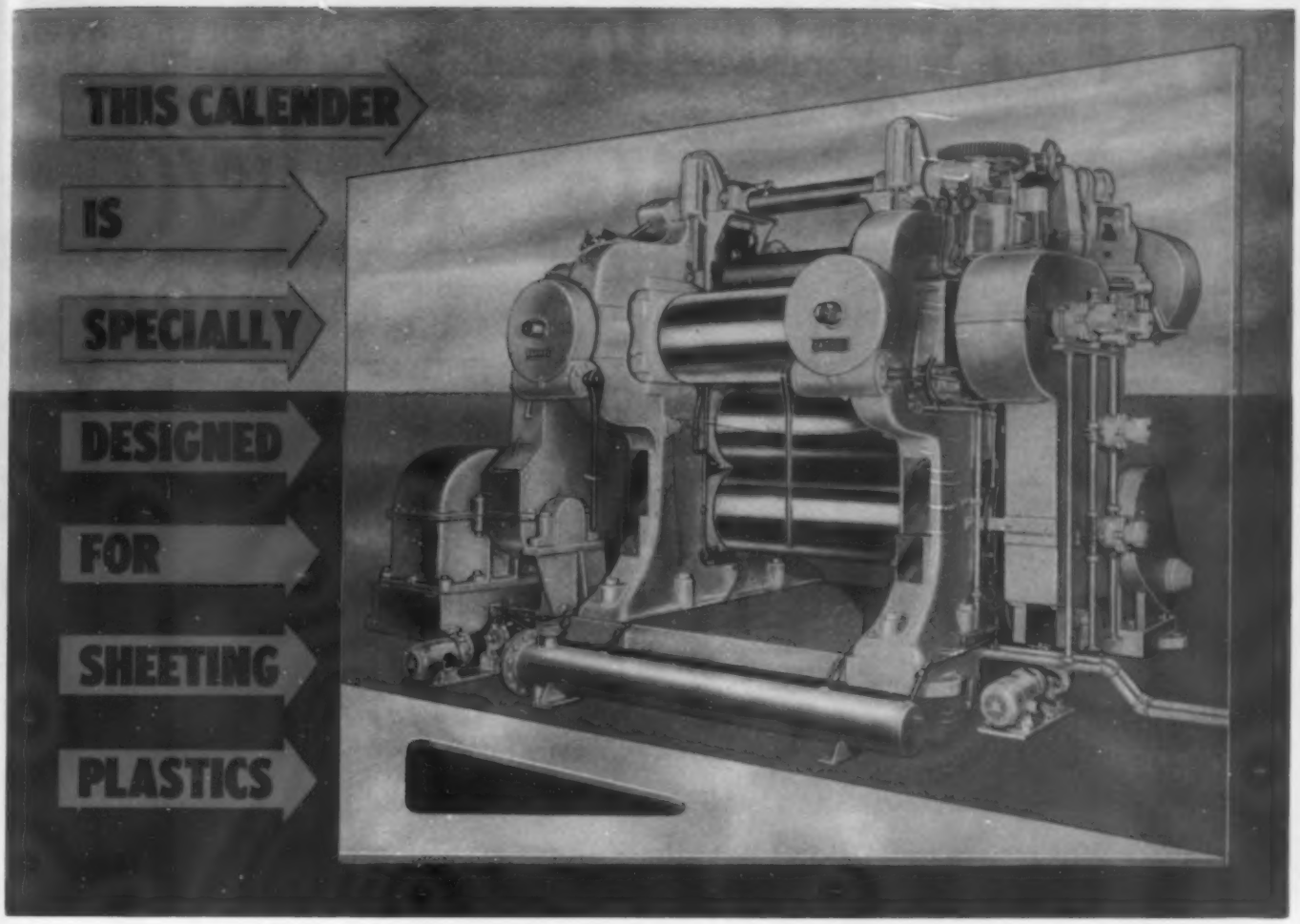
New York, N. Y.

BUY WAR SAVINGS STAMPS AND BONDS EVERY PAYDAY



It has four chilled iron rolls, 24" in diameter by 66" face. Three are arranged vertically, with the fourth at the side opposite the top roll. All four rolls are chamber-bored for high-pressure steam circulation, and are carried in full bronze-lined journal boxes, lubricated by a continuous circulating oil system.

The top and bottom rolls are provided with motor-driven adjustments, while the side roll adjustment is hand-operated. Safety bars and cables adjacent to points of operation assure quick emergency stopping through dynamic braking of the motor.

This is a typical example of the "designed-for-the-job" calenders we make for sheeting plastics. They can be supplied in a complete range of sizes from 8" x 16" for laboratory testing up to 28" x 84" for factory production, with any number and arrangement of rolls, and with the necessary attachments to suit a particular function.

We had been building calenders for almost a century — for the rubber industry — before the advent of plastics materials in sheet form brought this type of machine into use in plastics manufacturing. Thus, experience gained in the field of rubber has helped to make possible the many products which are today being fashioned from sheet plastics.

Write for further information regarding calenders or any of the other types of equipment listed on this page.

●

Farrel-Birmingham Co., Inc., Ansonia, Conn.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y. Sales Offices: Ansonia, Buffalo, New York, Pittsburgh, Akron, Los Angeles.

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- Banbury Internal Mixers
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- Hydraulic Accumulators
- Converting, Mixing & Sheeting Rolls
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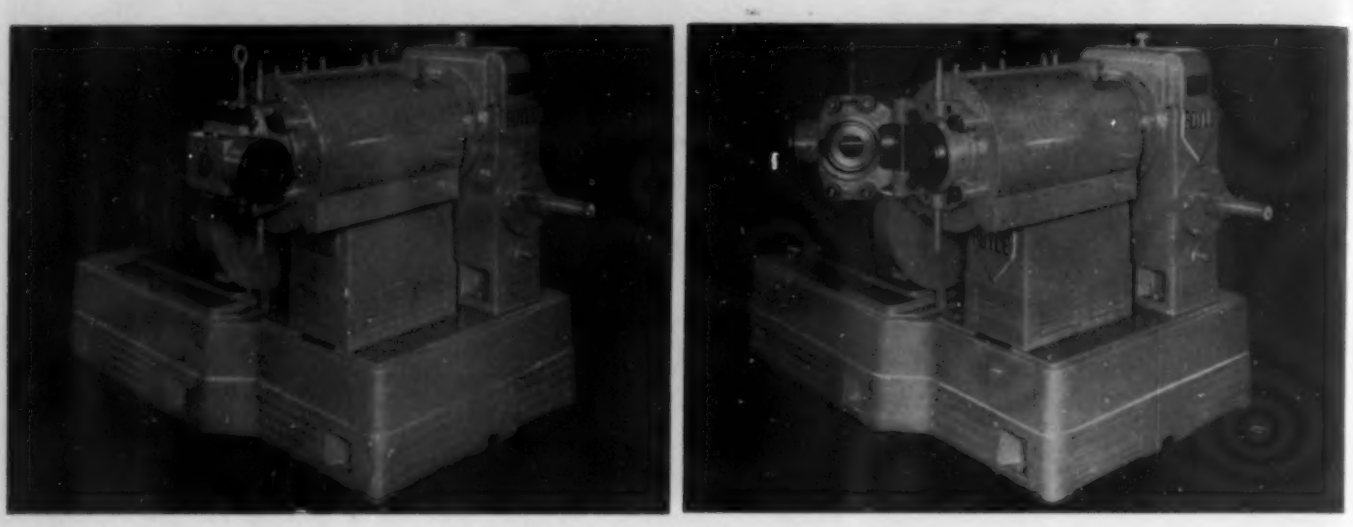
Farrel-Birmingham

BUILT FOR YEARS OF SERVICE



NO. 2 ROYLE PLASTICS INSULATING MACHINE

● Recently we received an inquiry from a customer who wanted to know if certain alterations could be made to one of their tubing machines. A check of our records revealed that the machine in question was delivered in July 1893—nearly fifty-one years ago.

It is encouraging to know that in these days of "use it up—wear it out" there are Royle oldtimers still capable of doing their bit on the "production front."

To-day, as always, our skills are devoted to designing and building continuous extrusion machines to meet the specific requirements of the application involved.

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RESISTS CORROSION OF INK CHEMICALS

RETAINS DIMENSIONS TO PREVENT LEAKING

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WIDER RANGE OF COLOR POSSIBILITIES

TOUGH, DURABLE, FOR ROUGH HANDLING

ALL THESE ADVANTAGES IN ONE LOW-COST PLASTIC

SO TOUGH
it is used to make billiard balls. (Toughest of all thermoplastics.)

SO BEAUTIFUL
in finish it is used to make luminous pearls.

SO EASILY FABRICATED
by drilling, punching, sawing, turning, . . . can even be printed and polished.

SO RESISTANT TO CHEMICALS
it is used to make storage battery casings.

SO STABLE
dimensionally (will not warp, swell, shrink) is used for drawing instruments.

SO UNLIMITED IN COLOR
possibilities—pastels, vivid opaques, tinted transparencies, and pearl effects.

SO RESILIENT
it is the standard for ping-pong balls.

SO CLEAR
it is used for identification card windows.

SO LOW IN COST
it is used to make thousands of beautiful, inexpensive trinkets and novelties.

FREE check chart
Includes helpful technical information and complete list of fabricators of nitrocellulose plastics. Write today for your free copy.

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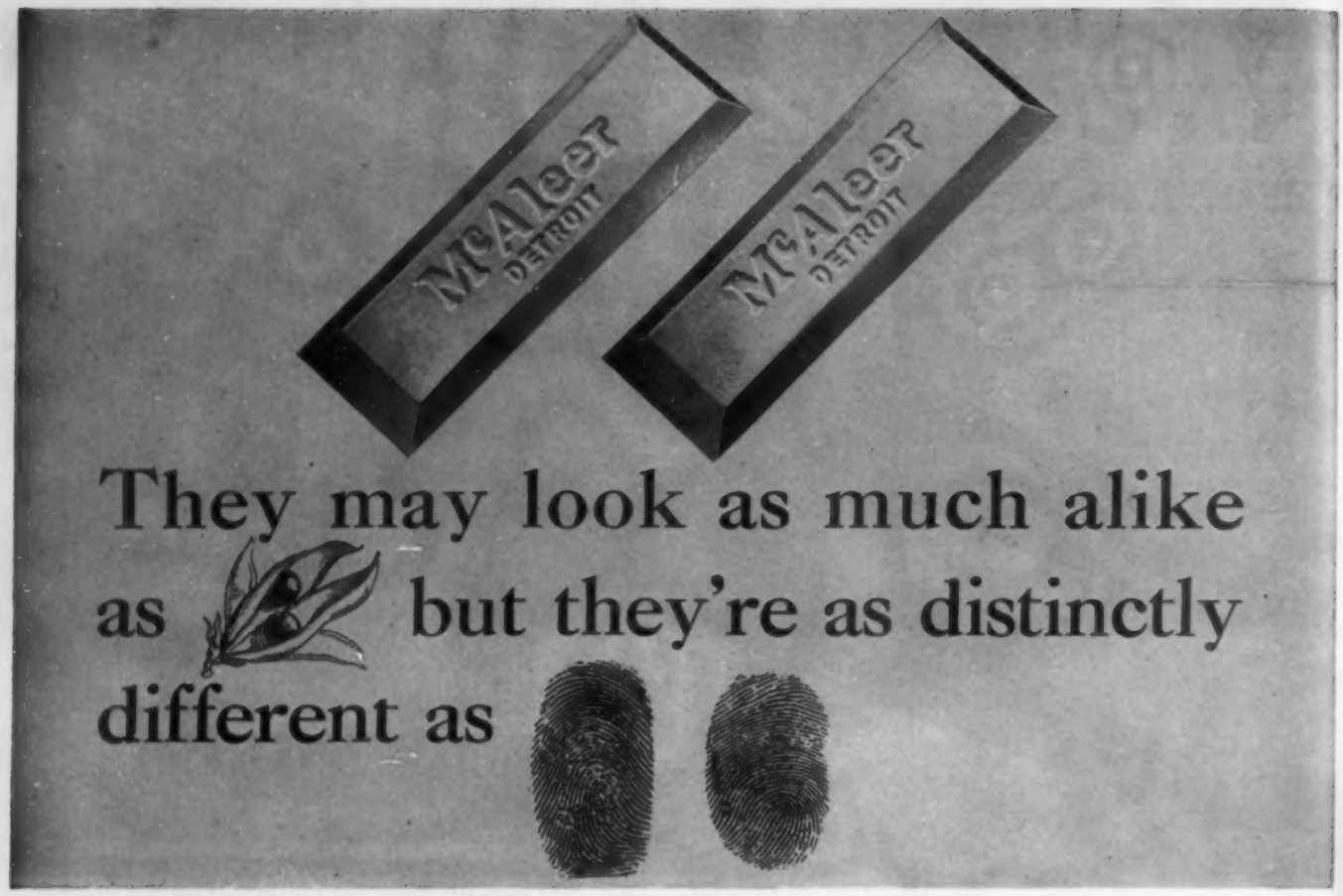


They may look as much alike as but they're as distinctly different as

WHEN we want to express similarity of things, we sometimes say "alike as two peas in a pod" . . . an apt comparison if we disregard what peas are for. When we eat them, they don't all *taste* alike . . . That's the way it is with BUFFING and POLISHING compositions.

There was a time when any "all-purpose" composition was acceptable in most instances for the general run of finishing work. War production finishing demands changed all that. Today the former user of "all-purpose" materials has come to realize that you can't specify the things that make a product really superior. Skill, knowledge, facilities and an honest desire to do a good job can't be standardized . . . McAleer finishing materials, whether used for polishing or buffing aluminum, brass, steel, copper, nickel, chrome and other metals, or for removing small flash or fins, file marks, blow holes, tool or die marks from plastics, are as distinctively different in their job-fitted characteristics as two thumb prints.

They are made to do an exacting job, do it well and keep on doing it as long as need for the specific type of material exists. Standards protect the manufacturer on those materials which must be buffed or polished; but when your compositions bear the McAleer trade mark, you get more than standards—you are protected all the way.

The nature of our business requires McAleer Finishing Engineers in the field to be virtually *"Jacks of all trades"*. And, contrary to the old adage, they are *masters* of many. Individually these men are specialists. As a body their specialty is *versatility*. This extra *"know-how"* possessed by McAleer Field Engineers backed by the second-to-none laboratory and manufacturing facilities are dedicated to but one purpose . . . helping you solve your individual finishing problems, whether those problems involve the finishing of metals or plastics . . . or both. Whichever it is, let us demonstrate McAleer service on your meanest finishing problem.

PHENOL-FORMALDEHYDES • UREA-FORMALDEHYDES • ACRYLATES and METHACRYLATES • STYRENES • HARD RUBBERS
CASEINS • ETHYL-CELLULOSES • CELLULOSE ACETATES • CELLULOSE ACETATE BUTYRATES • CELLULOSE NITRATES

McAleer MANUFACTURING CO.

Manufacturers of Quality Controlled Finishing Materials

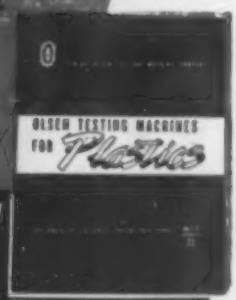
ROCHESTER, MICHIGAN

Designed especially for the Plastic Industry!

THE OLSEN PLASTIVERSAL

10,000 POUNDS TENSION
50,000 POUNDS COMPRESSION

Here is the last word in Universal Testing machines for the Plastics Industry. The Plastiversal was designed by Olsen to meet the specific needs of Plastics manufacturers and fabricators. Judging by the immediate response accorded it, this is equipment which fills a long-felt demand. Every detail has been engineered down to the last bolt on the recorder drum. Whether or not you have an immediate need for the Plastiversal, get the facts about it in Bulletin 23. A copy is yours for the asking.



BULLETIN 23

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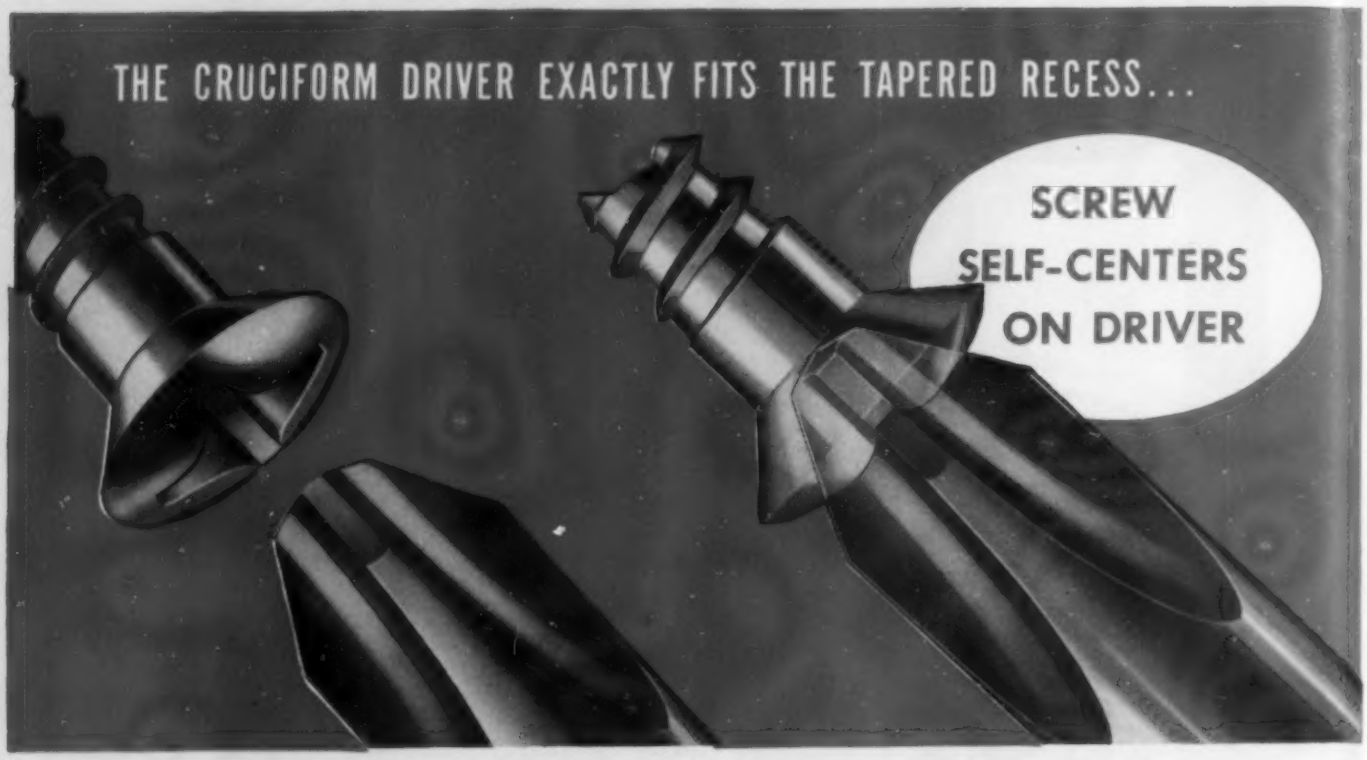
Representatives: PACIFIC SCIENTIFIC COMPANY
Los Angeles, San Francisco, Seattle
MINE & SMELTER COMPANY, Denver, Colorado

MADE BY NATIONAL SCREW...

the Phillips Screw with the engineered recessed head amazingly simplifies screw driving. Speeds it up 50% over less efficient, less modern methods



7 distinct advantages of the Phillips Recessed Screw

1. Self-centering on the driver
2. Holds driver from slipping
3. Four "wings" give greater driving power
4. Eliminates head breakage
5. Frees operator's hand to hold work
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National HEADED AND THREADED PRODUCTS

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

MODERN PLASTICS
APRIL 1944 VOLUME 21 NUMBER 8

Realities or reveries?

A fact-finding excursion into the realm of tomorrow's molded and fabricated small wares. Will the public still go for "gadgets?" What of the premium field? Is industry propaganda hypnotizing the industry itself?

NO ONE doubts that the impact of the war on the plastics industry is certain to produce far-reaching results in the postwar era. The realities of today are, in many instances, the fanciful dreams of a few years ago and the dreamers—both practical and fantastic—still are deep in their reveries, busy conjuring up a "brave new plastics world."

Plastic houses filled with plastic accessories from bathtubs to bud vases, revolutionary new automobile bodies utilizing the broad factors of light weight, unending color and transparency—these and a thousand other practical and impractical applications of plastics to the world of tomorrow have been presented in printed word and artists' conceptions to a public presently denied even the prewar requisites of a high living standard and thus hungrier than ever for the handsome array of merchandise so glibly promised in the better world to come.

The brand of propaganda which has appeared in the pages of numerous consumer publications has, if nothing else, whetted the public appetite for plastics and more plastics. But what is it doing to the industry which will design, engineer and produce this fantasia of molded articles? Is the industry itself hypnotized by the propaganda to which it has been an unwitting—probably unwilling—heir? Is the glamour which surrounds the design, manufacture and merchandising of dream-world products overshadowing the cold, hard facts and figures of tonnage and dollar volume accumulated throughout the prewar years in the production of small wares—that infinite array of merchandise ranging from ash trays to yarn holders?

It is an eye-tempting banquet that has been cooked up for the industry (and the public)—this rich, exotic, colorful array of plastic fantasmagoria. And rationing always sharpens the appetite! But what of the burned fingers, the woes of trial and error, the behind-the-scenes headaches which accompany the non-production of readily salable tidbits while the fare for the lush banquet table is in preparation? How does the potential tonnage of caviar and lobster thermidor stack up with pork and beans and corned beef and cabbage?

In the prewar era, millions of pounds of materials went into

1—The color scheme of the modern housewife's kitchen can be effectively carried out in her small plastic utensils. These strainers, scoops, salt shakers, and measuring cups and spoons will make good postwar premium offerings

PHOTO COURTESY AMERICAN CYANAMID CO

1

2

3

4

the production of small wares—non-industrial applications—which found their way to ultimate use through regular retail channels or through the intricacies of premium distribution. So broad have been the aspects of both that it is wholly impossible to compute the tonnage figures or dollar volume in either field of merchandising. Suffice it to say that the development of almost every new material was made with an eye to the tremendous potentials which lay in the production of low-priced, highly useful and sometimes charmingly useless small wares. And it is safe to say that more than half the molders who have set up shop in the last 15 years did so with the idea of cashing in on the ever-increasing public demand for such merchandise.

The profitable premium

In the premium merchandising field, there are men who will tell you that present-day public acceptance of plastics is traceable to the introduction of molded products into the home in the form of premiums. Successful merchandising through the use of premiums is an old, old story in American industry (in 1888, an illustrated card was given in return for 25 Larkin soap wrappers), but the entry of molded plastics into this ever-changing and fascinating realm of promotion is as new as the development of the infinity of color which gave such impetus to the plastics industry.

As color was the handmaiden of the ureas and acetates, so was it a device with which to intrigue the public. Perhaps it was the psychological drabness brought about by the lean years of the early thirties that made the public welcome a cheerful note at prices a diminished pocketbook could pay.

Before the war put an end to such civilian applications, plastics were popular for premiums. 2—A leading manufacturer of advertising novelties used cellulose acetate in mottles and clear colors for lighters, mechanical pencils and diminutive sewing kits. 3—Knitters appreciated transparent acetate containers that kept their yarn clean and unsnarled. 4—Designed to hold cans of a well-known cleaning powder, urea containers came in 4 colors to match kitchen trim. 5—An ingenious combination of ash tray and match holder molded of phenolic material was favored by smokers in the mid-thirties

, COURTESY CELANESE CELLULOID CORP. (2, 3) AMERICAN CYANAMID CO. (4). BAKELITE CORP. (5)

5

COLOR PLATES, COURTESY CELANESE CELLULOID CORP.

6—A representative group of prewar plastic premiums and advertising novelties includes charms in the form of trademarks, miniature replicas of the advertisers' products, toys and useful household wares, all molded of colorful acetate

Plastics had the answer, and hard-pressed-for-business and competition-groggy manufacturers were quick to tie in color psychology and the new availability of color at low cost with their efforts to make premiums bolster a sagging volume. Toothpaste manufacturers, soap makers, cereal and food producers turned to premiums, and colorful plastics were introduced into millions of homes.

One of the first premiums molded of plastic material to gain wide distribution was a bathroom tumbler molded of the then new urea-formaldehyde resin. A toothpaste company was the public's benefactor and in short order—even in 1932—more than 2,000,000 bathrooms harbored a new, practically unshatterable tumber and a bottle of the new antiseptic mouth wash. At an ounce each, 125,000 lb. of material went into this item, the molder kept a lot of compression presses busy a good many days, a new mouth wash was helped to quick consumer acceptance—and who will doubt that many a family thus got its first piece of utilitarian plastics ware?

Launching a new cereal isn't the simplest feat in world—even for a big-timer like General Mills. Wheaties was this industrial giant's new type cereal. Its appeal was both to children and to adults, and thus an introductory device designed to capture the interest of youngsters and their mothers was needed to help launch this newcomer into a sea of hard-boiled competition and low prices. Again plastics had the right solution to the problem and the result was the Skippy bowl, given free with two packages of cereal. Colorful, light in weight, capable of withstanding hard usage, cleverly decorated with a cartoon character which tied in with radio and magazine advertising, the Skippy bowl was a natural. Kids demanded it and doting mothers were quick to see an easy way of getting nourishing cereals into their sometimes recalcitrant offspring. Grocers liked it because it was well packaged—24 with each carton of 48 packages of Wheaties. When opened, the carton became a well-designed, forceful counter or window display piece.

General Mills advertised the new, attractive and relatively unknown urea plastic on a large scale, and millions of the bowls were distributed in approximately two weeks. One molder alone, using a $20,000 mold and 720,000 lb. of material, turned out 6,000,000 bowls and sold them to the advertiser for 5½ to 7 cents apiece. In the two or three years that followed, General Mills distributed nearly 30,000,000 such plastic premiums as measuring spoons, cups, cookie cutters—in effect, one to every home in the United States.

Another famous cereal bowl was the Mickey Mouse offered by General Foods. In the years 1936–37 the company distributed 8,400,000 bowls, according to the advertiser. Each bowl weighed 30 grams, which meant that some 560,000 lb. of material went into the job. The cost of each bowl to the advertiser, including freight, but excluding cost of mold, was approximately 4 cents. (*Please turn to next page*)

COLOR PLATES, COURTESY BAKELITE CORP.

7—For the retailer, small plastic articles present no display problem. Here a striking group of jewelry and novelties depends on varying shades of the same color to bring out the peculiar qualities of phenolic, acetate and polystyrene plastics

General Foods offered several other plastic premiums, using them with great success until 1941 when the war put an end to this type of advertising. In 1940, for example, the company began distribution of a phenolic coffee spoon premium with their Maxwell House Coffee. One hundred thousand of these spoons (at $29 a thousand) had been ordered for the test—it is usual for the advertiser to test his premium in two northern and two southern cities before ordering the millions usually distributed—when Government regulations forced the company to switch from metal to glass coffee containers, which so increased their costs that they discontinued the premium.

General Foods' last big plastic premium was the Swansdown and Calumette measuring set, consisting of a set of measuring cups in different colors, four measuring spoons and a small scoop, all of urea, given for one Swansdown box top or one Calumette inner seal plus 25 cents. Distribution began in March 1941 and was advertised by Kate Smith over the radio. Because of the cost to the consumer this premium (which cost the company 19 cents a set, exclusive of mold cost) ran to a mere 300,000.

Another popular plastic premium was the Bab-O container, distributed in 1939–40 by B. T. Babbitt, Inc., with their Bab-O cleaning powder. The container came in four colors and was sold with a can of Bab-O for 25 cents extra, either directly to the consumer by the retailer or by mail from the company's New York offices for a box top plus 25 cents. Mold cost was $3000, and the cost of the container to the company was 19 cents, exclusive of the cost of the mold and mailing charges. The Babbitt company estimates that 1,000,000 were sold, each containing some 5 oz. of plastic material, which means that over 300,000 lb. went into the item. The company found this a very successful premium and hopes to resume it after the war.

Among other large-volume plastic premiums were the iced-tea spoons distributed by Lipton and the A & P, in sets of six and eight. Molded of urea and polystyrene, the plastic spoons ran into millions of sets. Kolynos tooth paste, Old Dutch Cleanser, Borden dairy products, Quaker Oats and French's mustard are among the products that have at one time or another carried plastic premiums.

Figures speak for themselves, and it is scarcely necessary to point out the tremendous volume of business which these figures represent. For the Mickey Mouse bowl premium alone, the advertiser paid the molder $336,000, and the molder of the Bab-O premium collected almost $200,000 for the containers. Howard Dunk, secretary of the Premium Advertising Association of America, estimates that volume in the premium business doubled between 1930 and 1941, rising from $200,000,000 or $225,000,000 in the former year to $400,000,000 or $450,000,000 in the latter. Mr. Dunk believes that there is no limit to the expansion of plastics in this field after the war, and suggests that molders have stock molds ready for *immediate* postwar use in order to be able to supply several items for premium offerings, such as kitchen and bathroom articles, instantly and at low cost. He believes that if it were possible to make a temporary mold for running off 10,000 sample pieces before a costly custom mold is built, it would be a great inducement to advertisers.

H. W. Marks, advertising manager of *Printers' Ink*, points out that premiums run in cycles and should come back strongly with the revival of competitive trade. Plastics, he thinks, are particularly suitable for premiums because of their color, and the fact that they can provide most of the items customarily used for premiums. Bowls, dishes, jewelry, novelties, pencils, boxes, re-use packages, applicators and holders used to be, in prewar days, the chief premium articles, and all of these are good fields for plastics.

In Mr. Marks' opinion, the reason that many manufacturers mistakenly say that there is nothing in the premium field is that they often pay no attention to the needs of their customers. Frequently they turn out a novelty which, in *their* opinion, is suitable for premium use, and then are disappointed to find it not wanted. The premium, he emphasizes, *must be planned to meet the needs of the user*, and it is important to consult him first. Some companies will use only premiums designed for re-use; others require premiums which tie in with their products; and still others look for a premium associated with some radio advertising character, such as the Don Winslow and Tom Mix badges and notebooks. (Molders might ponder, in passing, the fact that such plastic items as bowls, which were originally very popular as cereal company offerings, lost ground in the late thirties to Dick Tracy pins and badges and other such paraphernalia, which appealed directly to children rather than to their mothers.)

At first glance Mr. Marks' advice might seem to be a direct contradiction of Mr. Dunk's. The former's suggestion that stock molds be ready, however, was designed not as a permanent policy for molders but to get the industry into immediate postwar volume production.

Frank H. Waggoner, longtime editor of *Premium Practice*, has this to say of plastics in the premium field: "I think molded products will make their appearance as premiums in many new fields. Their light weight, vast color range and durability will offer severe competition to other materials used for premiums. How far the plastics industry goes in capturing its share—or more—of the premium market will depend largely on how thoroughly and extensively it plans the design and production of new items and how determinedly it cultivates premium users—past, present and prospective—to acquaint them with items which will be available for premium distribution. In that way only can the plastics industry meet the inevitably tough competition of light metals, glass and pottery. Regardless of how far away the end of the war may be, it is not too soon to start intensive cultivation of this huge postwar market. The competition is doing it now—and booking orders for future delivery.

"The molders, it seems to me, have relied too much on the material manufacturers to promote the use of plastics, create interest and all but write orders to be turned over to them. More molders should develop their own sales organizations to go after business instead of waiting for material producers to throw them an occasional bone."

Since the premium field is second only to the chain store field as an outlet for small goods, a negative Government attitude toward this form of advertising, evidenced by anti-premium clauses in certain WPB orders, caused much concern among manufacturers of such consumer wares. At a recent meeting of the Premium Advertising Association of America, however, it was announced that in response to work on the part of an Association committee, WPB had rescinded these orders; and that members of the premium industry in visits to Washington had explained the economic significance of premiums "with the result that unwarranted bias against premiums was corrected." The premium industry, which is described as having an annual volume in a normal year of $500,000,000, takes a favorable view of postwar business. The future of plastic premiums, therefore, may be viewed with optimism. The farsighted molder will do well to study premium possibilities, remembering that a good premium is his best friend in a tight spot.

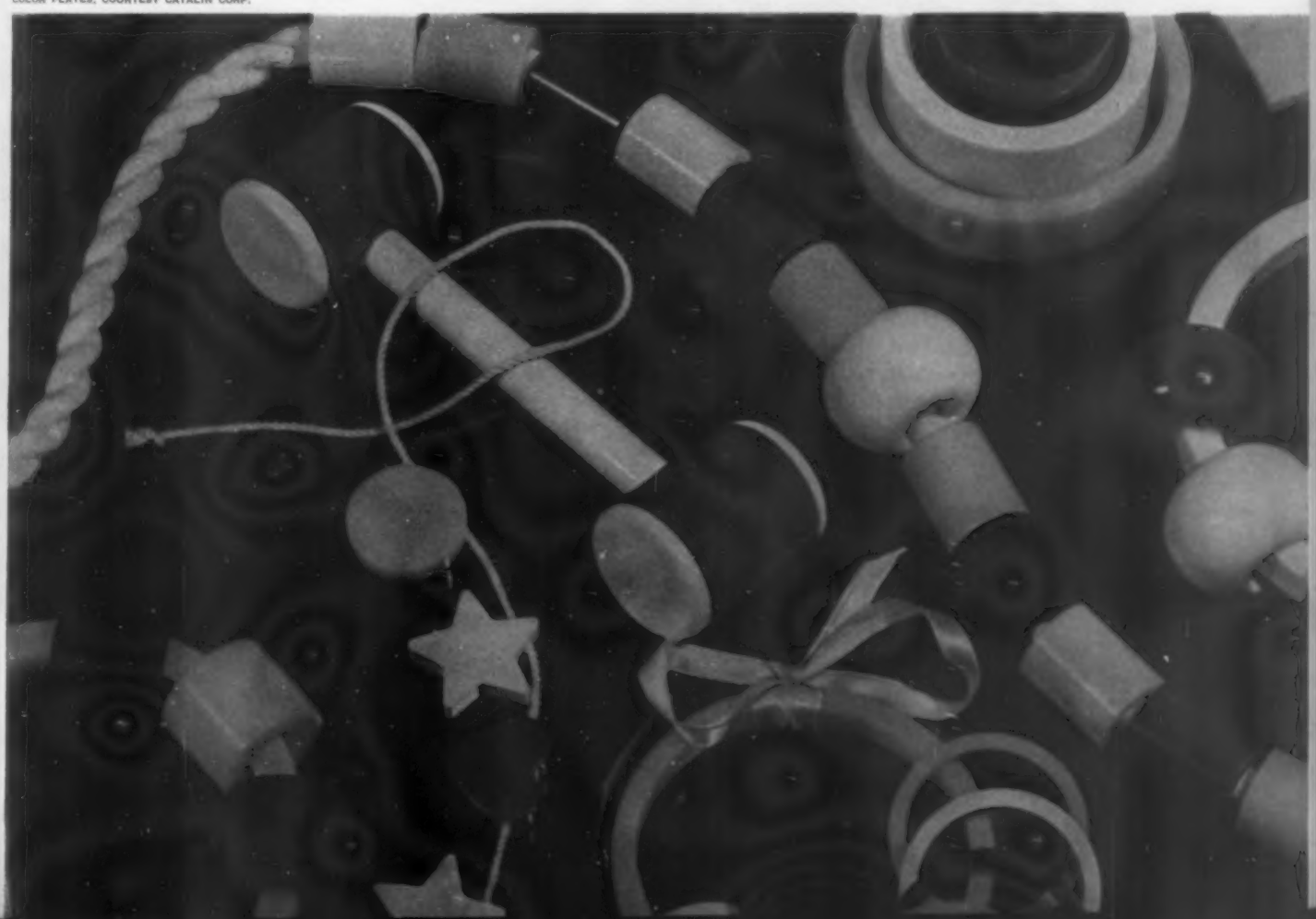
The housewife goes shopping

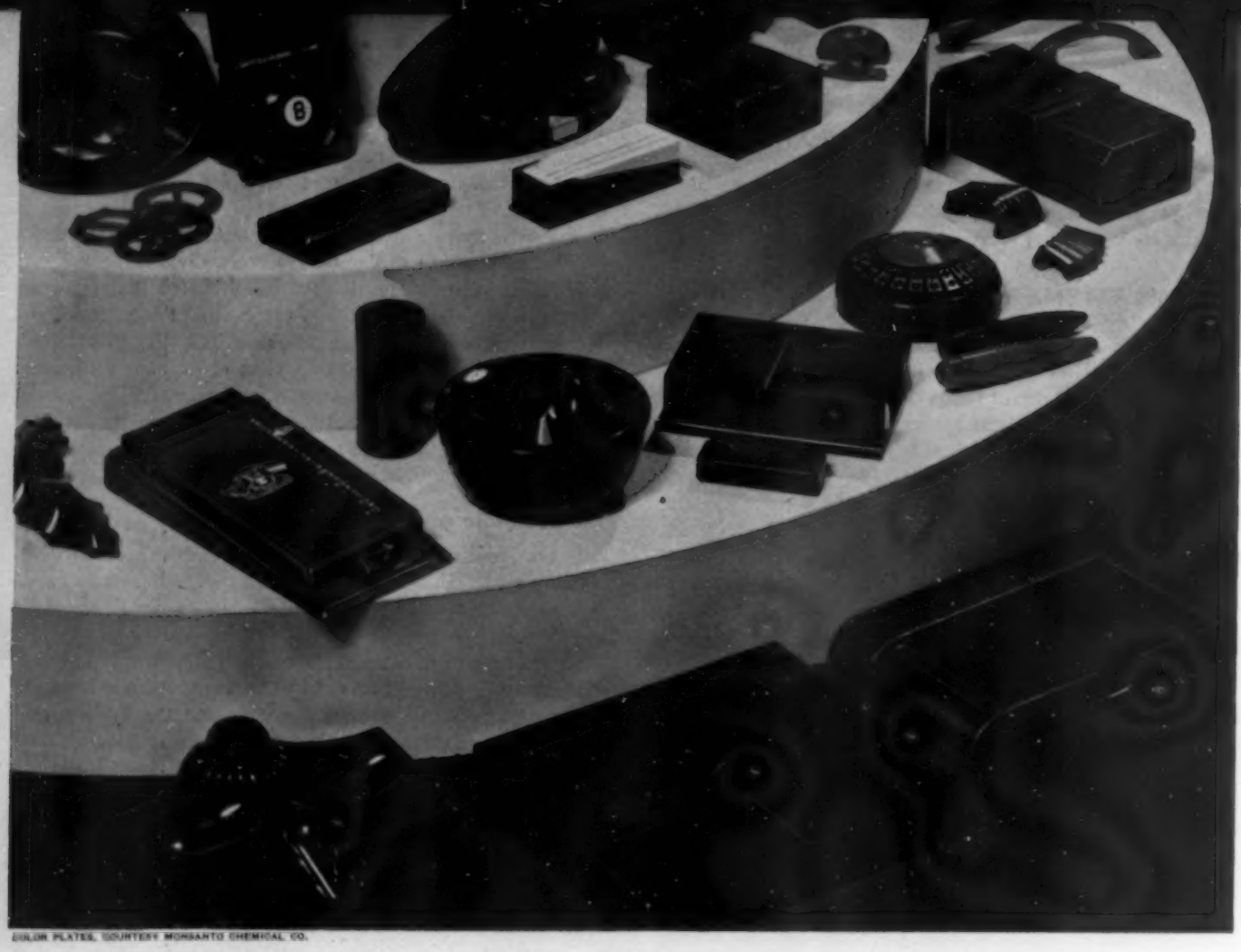
In the prewar era, production and consumer acceptance of small wares distributed through regular merchandising channels paralleled premium distribution. If the public wanted a wide variety of molded plastics as inducements for buying other unrelated merchandise, the same public would buy an even greater volume of an even wider variety through retail stores. So reckoned the great chains and the syndicates. And they were correct—as they usually are in judging the public's demand. Color was King, and no other material could offer such variety as could plastics.

Kitchen gadgets, household wares, personal accessories, hobbies, toys, office equipment, advertising specialties, dual-use and novelty packages consumed countless tons of materials, new and old. New molders sprang up like mushrooms,

8—Pre-Pearl Harbor infants were blessed with toys like these, fabricated of smooth, delicately tinted cast phenolic. Mothers could look on placidly as their offspring chewed on rings and beads, because the odorless, tasteless plastic playthings were nonflammable, non-toxic, easily washed and their color couldn't be licked off

COLOR PLATES, COURTESY CATALIN CORP.





COLOR PLATES, COURTESY MONSANTO CHEMICAL CO.

9—The deep, rich tones of the phenolics adapt them ideally to small articles for office desks or library tables like these cigarette boxes, ash trays, fountain pen sets, calendars and memorandum pads

designers ran riot and buyers went wild in their frenzy to give the public what it wanted. Inevitably, a lot of "junk" was produced and many were the sins of molding both right and wrong articles out of wrong materials. But small wares sold —and mass productionitis was in its heyday.

In these peacetime years, the manufacture of kitchenware, toys, novelties and gadgets provided the basic overhead of the plastics industry. One supplier of urea material estimates that in 1939 tableware, toys, novelties and display items absorbed 20 percent of his entire production—the bulk of this going into chain store merchandise. When the war broke out and metals were restricted, plastics replaced metal in small goods until they, too, were restricted. Since that time, the limited amount of plastic wares which has been available for civilian use has been molded or fabricated chiefly of scrap or reject materials.

When approached on the subject of plastics the average man says that "the future of plastics is unlimited," and he is enthusiastic but vague about what forms this future will take. He speaks nebulously of a plastic car and a plastic age, and the fact that during the war years 90 percent of the industry has been engaged in war work has added to his mystification. Strange new war manufactures—ammunition components, aircraft parts, complicated electrical devices—have built up in his mind a picture of a Wellsian world manipulated by plastic buttons and transported in plastic airplanes from rosy peak to rosy peak. But even a Wellsian world needs kitchenware and picnic dishes and babies' toys, if it's going to be a comfortable world.

With the neglected wartime housewife in mind, we toured the dime stores and one or two of the more expensive shops to see how she fares—whether she still has the small things which go to make comfort, or whether she lives like an *ersatz* war bride. Surveying the plastic wares still left on the market, we found that, while most of her larger plastic household appliances have disappeared, a great many small ones suitable for manufacture from scrap still remain. In the field of kitchenware, where the American creed of utility first and beauty second made her labor-saving devices the envy of the European world, we found that many had gone or been replaced by dubious substitutes. Electric mixers, juicers and other devices latterly molded in part of plastic material had gone, as had her colored tableware and children's dishes, and the gay plastic-handled knives and forks for her breakfast table. Still in evidence, however, were kitchen forks and spoons, and such small but indispensable gadgets as strainers, apple corers, measuring spoons, cheese graters, cookie cutters, scoops, funnels, sink stoppers and strainers.

Always carrying the torch for the American housewife, we interviewed the buyers for chain store syndicates, the managers and buyers of the individual stores and—most important of all—the girls behind the counter, who *are* the American housewives. They are also the buyers, putting in their orders to the store manager who orders direct from the molder. Finally, it is they who receive the public inquiries and complaints. Of a 24-hour day, they spend 9 hours selling their products and 3 or 4 hours trying them out at home. Their opinion, consequently, may be taken as an excellent indication

of which articles are 1) the most popular and best-selling, 2) the most utilitarian, from the purchaser's point of view.

Universally praised were the plastic articles now missing from the counters—the prewar picnic and children's dishes usually made of urea (mugs, bowls, cereal dishes and plates) which competed with and outsold glass and metal dishes in most localities. The colored dishware was used chiefly for picnics and outdoor porch breakfasts, but the plastic-handled knives and forks, reminiscent of English bone ware, appeared on the most solemn dinner tables and sold in Canada as well as in the United States. The bathroom accessories now largely missing—mugs, towel racks and soap dishes—were also lamented best sellers and were said by many buyers to be more popular in plastic than in other materials.

Many a plastic gadget put on the market by the war restrictions on metal was highly successful. A cheese grater, looking mildly innocuous after its wicked tin predecessor, so often hung up to dry with bits of skin and cheese on its jagged points, is very popular and is now being demonstrated at a large department store to show that it grates the cheese finer and is easily washed—"just swoosh it in hot water and bang it, and it never tears the towels like the old ones." Funnels and sprinklers and sink strainers were also popular. Iced-tea spoons, straws, shower curtain rings and novelties like a switch plate wall shield of acetate (protection against grubby little fingers) also sold well, but by far the most popular gadget of all was a small tea strainer made in cream and red colors and sold with a label stating that it "does not rust, does not

10

11

12

10—*Mothers and children alike welcomed such premiums as non-shatterable urea nursery dishes decorated with familiar comic strip, motion picture or radio characters, which made cereal and milk more interesting.* **11**—*Plastic jewelry and novelties sell rapidly in the chain stores, come in colors to match every costume and at prices to fit every purse.* **12**—*Amusing brooches and lapel pins molded of acetate have never lost their customer appeal*

PHOTOS, COURTESY AMERICAN CYANAMID CO. (10), CELANESE CELLULOID CORP. (12)

13

14

tarnish." Measuring spoon sets and scoops were popular, too, and in spite of some complaints about warping they sold side by side with aluminum before the war, probably because of their bright colors, which many buyers felt was the leading selling point of plastics.

But there is a darker side to the story of plastic kitchen utensils. Certain unsuccessful applications of plastic material have put on the market unserviceable, non-functional kitchenware—articles with too thin wall sections and thus easily warped or broken—which have prejudiced the public against such applications for some time to come. The purchasers, because they do not realize that such utensils were manufactured under the stress of war and non-competitive conditions, and that they violate the most basic rule of all design, viz., that *the material must be suited to its use*, lay the blame on the material itself.

Unserviceable, non-functioning household articles build up a nostalgic memory in the housewife's mind of their prewar metal counterparts, and a fine postwar resistance to new plastic wares. Because the public has never been educated about the differences in plastic material, the average person thinks there is only one "plastic." The answer, not only of the girls behind the counters in the dime stores but also of clerks in more expensive stores, to the question "What kind of plastic material is this made of?" is usually simple and succinct: "Why it's just *plastic!*" The housewife, too, imagines that there is only one plastic; she does not stop to reflect why she liked her old plastic picnic and baby dishes but not a certain new plastic knife.

This prejudice built up by flimsy, non-functioning household manufactures is so serious that the buyers of two syndicates which sell to most of the large chain stores warn that the use of plastic kitchenware may decrease after metal comes

13—*Before the war, plastic doll tableware was a universal best seller. The young owner of this impressive pink acetate set can lay covers for 6 dolls.* **14**—*Acetate scrap forms mahogany-colored Early American doll furniture which moves swiftly from counter to customer.* **15**—*Also of scrap material, small acetate ships and airplanes, which are still available in small quantities, are equally easy to dispose of, and many more could be sold*

PHOTOS, COURTESY IDEAL PLASTICS CORP. (13, 15), NEW YORK MERCHANDISE CO. (14)

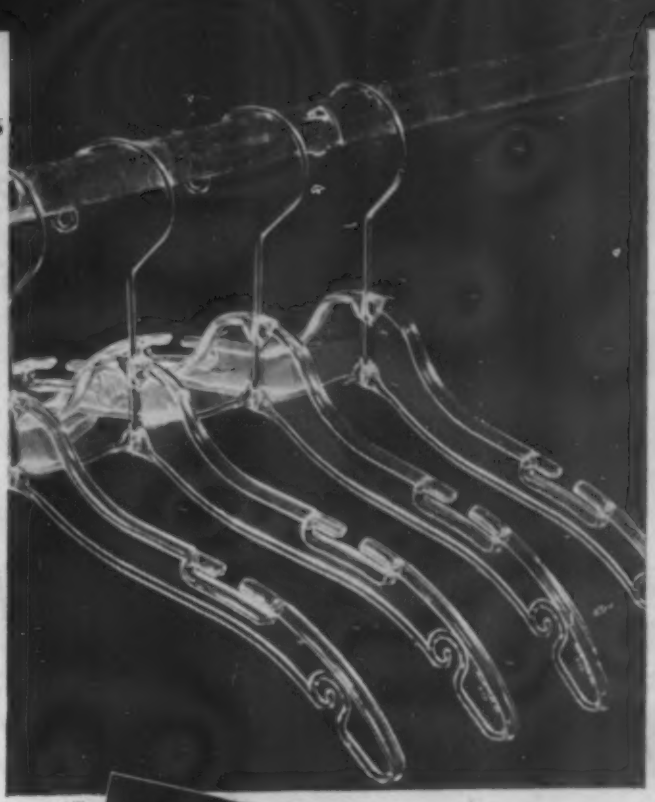
15

back. After the war they plan to buy the old plastic staples such as bathroom accessories, picnic ware and children's dishes, and such new small utensils as the popular ones already mentioned, but to eliminate many an unsuccessful, flimsily made article. Stone Age knives that hack but never cut, tie-backs too flimsy to hold the curtains, sink stoppers that don't fit the drains, poorly designed flashlights and razors, it must be admitted, do not make satisfied customers! There are, of course, well-designed, heavy curtain tie-backs to be seen in the more expensive shops, and there are plenty of sturdy, well-made plastic flashlights, but they are not to be had at chain store prices.

Which brings up another frequently heard criticism of small plastic wares: their high price. In normal times, syndicates which supplied chain stores sold knives and forks wholesale for 20 cents a dozen, whereas the plastic ones sell for 75 cents a dozen. Similarly, spoons used to retail at 3 for 5 cents, a price not met by their replicas in plastics. This suggests the second rule of all commercial designing for chain store use, one which is frequently overlooked, i.e., that the article must be competitive in price.

It can be pointed out that many of the articles above mentioned could be sold successfully if the housewife knew how to take care of them. Since she makes no distinction between types of plastic material, she naturally does not know their varying properties. Plastics are still, to the consumer, very new and faintly miraculous materials and, therefore, plastic articles of kitchenware should carry informative labels giving suggestions for their care. If our housewife had been warned by an attached tag that her acetate measuring spoons could be put in warm but never in boiling water, she would still be a pleased customer. And she is used to this type of instruction. Joe's flannel shirt carries a label (*Please turn to page 172*)

16



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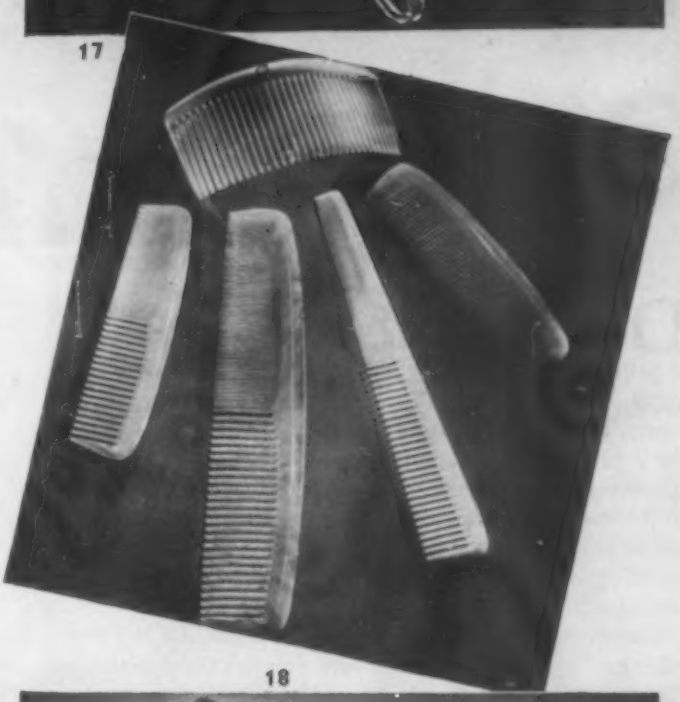


18

16—*Transparent acetate coat hangers find favor in the field of closet accessories, where cleanliness, light weight and pastel shades are requisites.* **17**—*Tons of plastic material went into prewar combs, an application with an assured future.* **18**—*The jewel-like quality of methacrylate adds a note of luxury to the indispensable compact.* **19**—*An acetate cleansing tissue dispenser in soft pastel shades is decorative in bathroom or boudoir*

PHOTOS, COURTESY TENNESSEE EASTMAN CORP. (16, 17, 19), E. I. DU PONT DE NEMOURS & CO., INC. (18)

19

Hearing more for less

DEAFNESS, always a tragedy to the person so afflicted, is of even greater significance to the nation—particularly during wartime. Our production schedules have created a manpower shortage. To overcome this condition it is essential that labor operate with maximum efficiency. Yet of the 7 million or more adults who suffer from deafness in this country, a high percentage is unable to make a contribution to the war effort because sound comes to them too blurred to assure rapid understanding. And accurate, unfailing understanding of verbal orders is a "must" if today's accelerated factory schedules are to be met.

For many years the public has been able to hear the words whispered in Europe, Asia or South America through the medium of a radio receiver purchased at a cost of $29 or less. Yet people with deficient hearing, in order to hear the human voice across the room, have been forced to spend $100 to $200 for a hearing aid with qualities comparable to those of the inexpensive radio. To remedy this situation, a hearing aid has recently been developed which sells for $40 and is inexpensive to maintain. Contributing to the low cost and accoustical excellence of this device are two plastic parts—an amplifier unit and an earphone tube. The former is molded of polystyrene while the tubes or studs are of methacrylate.

Fundamentally, a hearing aid is part of a radio receiver adapted to a special use—that of wiring the human body for sound. This most recent instrument consists, in the main, of the batteries and battery cord, the amplifier unit, the earphone and earphone cord. The batteries supply the electrical energy needed to operate the hearing aid just as the batteries of a portable radio furnish the power to operate that set. This energy is transmitted to the amplifier unit through the battery cord which is attached to the case by a retaining clip. The amplifier unit contains a microphone which picks up sounds exactly as do the microphones used in broadcasting studios or in a telephone transmitter. These sound impulses are amplified by a radionic amplifier built with the precision of a fine watch. This unit has a quiet-type volume control which is enclosed in a plastic case in order to exclude dirt and moisture, and ensure quiet operation. At one corner of this case is the "off–on" switch; at the other a 4-position tone control which enables the user to select that combination of sound frequencies which best overcomes his particular hearing deficiency. Greatly amplified, the sound impulses, still in the form of electric currents, are carried by the earphone cord to the magnetic earphone where they are converted to sound. The earphone may be compared in function to the speaker of a radio. It is of the magnetic type because experience has indicated that this type is least susceptible to deterioration from humidity and temperature changes. Sound from the earphone is fed into the wearer's ear through a plastic tube which snaps onto the earphone and is fitted snugly in the ear by a rubber tip. The earphone assembly is attached to the amplifier unit by means of a cord.

There were several reasons for the selection of polystyrene for the case of the amplifier unit. When metal was used for this appliance, the case was frequently dented when subjected to sharp knocks. Under such treatment the paint with which the metal was finished tended to flake off. In comparison the plastic case withstands knocks and bangs without effect, and the material is capable of a high finish which will not wear off. Furthermore, in cold weather polystyrene is not cold to the touch as is metal.

The case is molded in two pieces in a 2-cavity mold. Thus one complete case—a front and a back section—is molded in each shot. Because of the time required for the handling of the inserts, for dusting the mold and placing the piece in a cooling fixture, a cycle of approximately 1 min. is required for the molding of these two halves. The front piece which

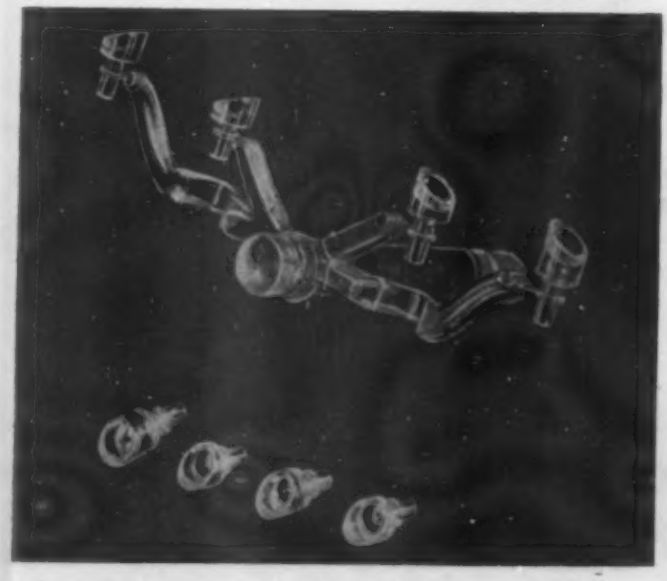
weighs 17 grams contains 4 inserts—two each of two different sizes. So nearly alike are these inserts to the casual glance that each size insert is distinguished by a different color, thus decreasing the chance for error in their selection prior to insertion in the mold.

Since the finished appearance of the case is of critical importance, the runner is removed from the shot while it is still soft. Care is taken to leave a liberal allowance at the gate. The 2 halves of the case are so constructed as to come to a feather edge at a point which will be noticed by the user when learning to make the necessary adjustments on his hearing device. To remove the gate, three operations are used in sequence. First the excess material is belt sanded away. This method is particularly convenient because the heat generated in the operation softens the adjoining plastic and thereby decreases the danger of chipping or fracturing the part. After belt sanding, the halves of the amplifier case are placed in a jig fixture and milled to finished size. Final cleaning of milled material is done by hand in a general touch-up inspection. On the front piece a very thin saw turning at high speed is used instead of the side milling operation employed on the back half. Both sections require jigs for rapid handling with a minimum of personal judgment. One hot stamping operation completes the case. As a final operation a white arrow is stamped on the compound curve at the top of the back piece. Since accuracy in the location of this arrow is very important, its placement must be held within close tolerances.

Subsequent to delivery to the radio manufacturer, a total of 5 holes are drilled in the amplifier (*Please turn to page 164*)

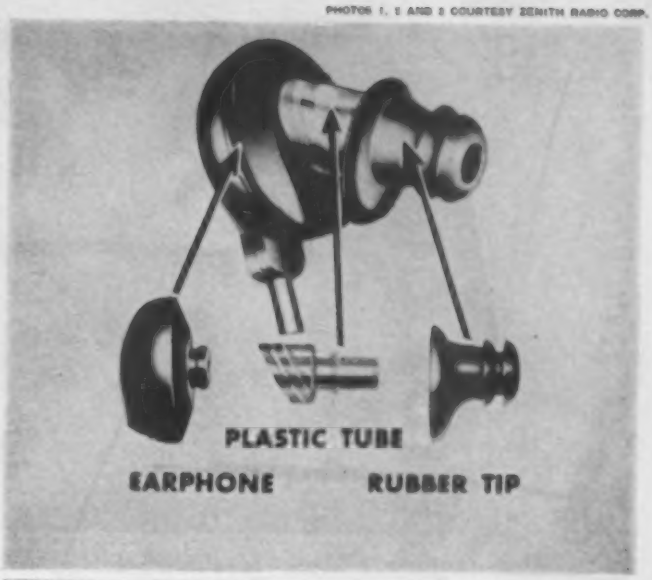
1—Because of its compactness this new hearing aid can be almost completely concealed. As can be seen, the proper hair dressing entirely covers the earphone and cord. 2—The magnetic earphone which converts electric currents to sound is composed of an earphone, a methacrylate tube and a rubber tip. 3—The component parts of the amplifier unit are clearly indicated on this drawing. The universal garment clip can be attached to either the front or back half of the case. 4—One complete polystyrene amplifier case—a front and a back section—is molded in each shot. 5—The methacrylate earphone tubes are molded in 4 different lengths. This variation in size is designed to compensate for physical variations in the individuals wearing the hearing aid

5



PHOTOS 1, 2 AND 3 COURTESY ZENITH RADIO CORP.

2



3

4

Developments in pattern plates

IN a broad sense, the art of founding may be described as making a hole in sand and filling it with fluid metal which, when cold, retains the shape and contour of the depression into which it was poured. As practiced in foundries for the production of sand castings in all the commercial metals and alloys, one of the most delicate steps in the process is the making of a container or mold of the form required in the final casting. This work is complicated by the ever-present difficulty of constructing a satisfactory parting line or division between the two parts of the mold which will assure a casting that is an exact replica of the pattern from which the mold was made. Toward the solution of this problem foundry men have progressed from the use of a loose pattern or model of the desired shape to the gated pattern and the follow board. The match plate in which the pattern and gates are mounted on a pattern plate, is now in common use in high-production foundries. While the original pattern plate was probably made of mahogany, a variety of materials have been used in this application—the latest being laminated lignin plastic.[1]

In the ordinary match plate, the patterns are split at the parting line—half the pattern being attached to the bottom side of the plate and half to the upper side. If the draft of the pattern is all in one direction, the model may be mounted entirely on one side of the plate. In the modern production foundry the match plate is used in connection with a metal slip flask or, occasionally, with a wooden snap flask in which the sand mold is made. In either case, the flask or molding box consists of the top or cope, and the bottom or drag. The two halves of the flask are held together and in alignment by the guide pin, and the parting line of the mold is made to conform to the juncture of these two sections.

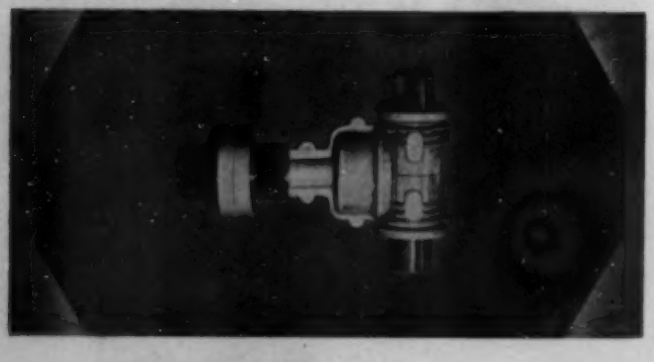
In ordinary production the flask is assembled with the pattern plate placed between the top and bottom halves. While in this position the top section is filled with sand. The entire flask is then jolted and the sand tamped down with various tools to assure its conforming to the outline of the pattern. After the open end of the cope has been covered to prevent the sand from escaping, the assembly is inverted. The drag or bottom part of the molding box is then filled with sand. The process of jolting and sand squeezing is repeated. In the next operation a vibrator is attached to the pattern plate. The action of this machine assists in freeing the sand-filled bottom half of the molding box from the pattern plate and pattern. The drag section of the molding box is then lifted from the assembly and inverted to assume its original bottom position. Next the exposed match plate is removed from the cope—care being taken not to disturb the sand mold. This half of the molding box is inverted as was the other sand-filled section, and placed in position upon its mate.

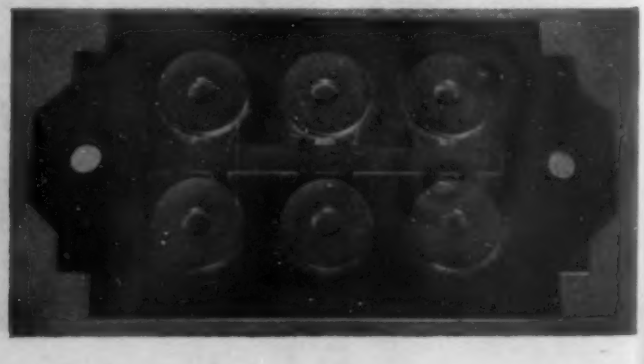
On larger work, the same general system is used but two boards—normally called cope and (*Please turn to page 168*)

[1] Lignolite.

The accompanying illustrations show typical mounted laminated lignin plastic pattern plates. These plates are suitable for the mounting of various types of patterns including those made of metal and wood

PHOTOS COURTESY MARATHON CHEMICAL CO.





SOCIETY *of the* PLASTICS INDUSTRY

Pacific Coast Conference

"PLASTICS at War in the West" and the rôle of plastics in the postwar period were the themes of the two-day annual conference of the Pacific Coast Section of the Society of the Plastics Industry which was held at the Ambassador Hotel, Los Angeles, Calif., on Monday and Tuesday, Feb. 21 and 22. The opening session which was presided over by Robert A. Cooper, Plastic Die and Tool Corp., was devoted to a survey of the plastics situation with particular reference to the West Coast. The address of welcome was delivered by the Honorable Fletcher Bowron, Mayor of the City of Los Angeles. E. F. Lougee, Plastics Industries Technical Institute, was chairman of the first luncheon session at which Charles A. Breskin, publisher of MODERN PLASTICS, spoke on the "Necessity for Salesmanship and Merchandising in Postwar Markets." Robert B. Gutsch, Plastic & Die Cast Products Corp., presided at the afternoon session. At Monday's dinner meeting Ronald Kinnear, Niagara Insul-Bake Specialty Co., introduced Lt. Peter Roback, U. S. Army, Regional WAC Recruiting Headquarters, and Dr. Rufus B. von KleinSmid, president of the University of Southern California, who spoke on "Postwar Economy." Plastics in Aircraft was the keynote of the Tuesday morning session at which W. I. Beach, North American Aviation, Inc., presided. Wm. T. Cruse, executive vice-president S.P.I., was chairman at the luncheon meeting which was devoted to a discussion of the "Postwar Trade Possibilities in Latin America" by Henry Humann, Banco Nacional de Mexico in the United States. At the close of the luncheon the Celanese Corp. of America presented a style show. Wm. T. Cruse was again the presiding official at the afternoon session which was given over to a Postwar Forum. Late on the same afternoon a series of motion pictures was shown including films by the March of Time, MODERN PLASTICS, Rohm & Haas Co. and E. I. du Pont de Nemours & Co., Inc. The business session and reception followed. A banquet brought the two-day conference to a close. George K. Scribner, president of S.P.I., introduced the speaker of the evening, Major R. H. Fleet of Consolidated Aircraft Corp. and Institute of Aeronautical Sciences. Major Fleet spoke on "Aviation, Savior of Civilization." Résumés of the speeches delivered at the two morning and afternoon sessions are presented on the following pages.

The chairman of the Pacific Coast section of the S.P.I., James D. McDonald of the McDonald Manufacturing Co., opened the program with a talk on "Problems of the Industry in the West." Briefly, Mr. McDonald spoke as follows:

Whether the listener is on the inside of the plastics industry looking out or the outside looking in, he should be vitally interested in the possibility that the stampede to plastics may be temporarily overdone due to the interruption of the orderly process of competitive growth by the war. As one remedy for this situation, Mr. McDonald suggested a fact-finding campaign on the part of the Pacific Coast section. A major reconversion problem exists in this area, the speaker continued. Hundreds of thousands of war workers will need other employment, and the demobilization problem will be aggravated by the desire of many out-of-state soldiers to settle in the state. Hundreds of young industries will spring up whose future depends on their ability to find some other type of work, and many of these industries are headed by young, dynamic men who plan to enter the plastics field. If this is a solution for some of our unemployment or will aid our western economy in any way, it must not be discouraged. But if it is a blind move made by men who are unduly influenced by the glamour of plastics, it will only add confusion to a situation concerning which we are already apprehensive.

Mr. McDonald said that the fact was that much of the business is too involved from the engineering standpoint to be either very attractive or very easy to enter. For instance, when the plastic containers industry now being assembled behind locked doors emerges, it will be with highly specialized equipment and techniques, protected by a wall of patents, and a material situation well in hand. In our Pacific Coast section, the speaker said, much of the raw material for low-pressure applications is at hand. There are untold engineering possibilities if we have sense enough to leave the beaten path. Product design is one of the most important functions of our industry since it can expand existing markets and create new ones, doing as little damage to other lines, such as the metal industry, as possible.

Mr. McDonald expressed the opinion that one of the most serious problems in our western economy is the labor surplus which will exist for some time after peace is declared. The attempt to reconcile this with wartime wage levels must result in turbulent labor relations. Another problem is the fact that in the old days of the depression one of the last moves in the competitive battle was the use of cheaper materials. That raises a most serious danger—the misapplication of plastics, caused either by using the wrong material or by using plastics in an application where no available material will be satisfactory.

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Clinton Rector, chief of the Plastics Section of the War Production Board, spoke on "The Plastics Outlook." His talk, which is given in brief, was chiefly concerned with future allocations of synthetic materials for civilian use.

In spite of the recently increased facilities for the production of ethyl cellulose, Mr. Rector stated, large military procurements expected within the next three months will render impractical its application for any but the most indispensable civilian needs. In February, requests were granted for its use in heat seal lacquer for essential dehydrated food, sterilizable adhesive backing, photo-engraving stripping solution and labels for food cans.

The demand for polyvinyl butyral, polyvinyl chloride and the copolymers has now made it impossible to meet all of our military requirements, the speaker continued. However, added facilities may ease the situation so that limited coverage will be secured for the most

Speakers at the Conference included: C. Rector, C. W. Blount, C. A. Breskin, J. D. McDonald, C. Lichtenberg, C. C. Sachs

essential civilian uses. Although the supply of most grades of vinylidene chloride is sufficient for war needs, none of these materials is now available for non-military purposes.

Mr. Rector pointed out that cellulose acetate plastics are obtainable for such important applications as electrical insulation, and industrial quantities are to be had for such items as buttons, combs and cosmetic containers. In most instances, due to the scarcity of phthalic anhydride, these compounds will be formulated with substitute plasticizers. Although this situation may improve slightly in July, it promises to remain critical during 1944.

The only bright spot in this survey, in Mr. Rector's opinion, is found in the urea and melamine materials, now available for furniture, baby cribs and strollers, luggage, table tops, shoe soles, buttons, closures, hardware appliance parts, wiring devices and office equipment. Although some of the less necessary applications may be eliminated to conserve formaldehyde, this condition seems likely to continue for the remainder of the year. The speaker expressed the opinion that acrylic and phenolic resins will probably remain critical during 1944. However, there is a possibility that additional polystyrene may be available within the next six months.

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P. W. Griffith, of the Plastics Division of American Cyanamid Co., spoke on "Anhydrous Thermosetting Resins." He emphasized the adaptability of these materials to low-pressure laminating by the bag or diaphragm process using simple, inexpensive molds and equipment. He also discussed their use for casting colorless flat and curved shapes of outstanding heat resistance and excellent electrical and physical properties.

Exceptional dimensional stability is an outstanding characteristic of these cotton and glass fabric laminates, Mr. Griffith stated. Curing time for sheet laminates from $^1/_{16}$ to $^1/_2$ in. thick ranges from 20 min. to 1 hr. in ovens heated to approximately 240° F. Pressures varying from contact to 100 p.s.i. are used, depending on the base material and the resin content desired. The speaker said that these resins are comparatively light in weight. Although relatively high priced when they were first introduced, their cost has now been reduced over 25 percent.

A valuable property of the liquid thermosetting type resins from the fabricator's viewpoint, Mr. Griffith continued, is its ability to act as its own adhesive. In laminating, rapid assembly produces a material of much higher modulus of elasticity and greater rigidity than that resulting from a longer period. The cast resins have an abrasion resistance considerably superior to that of the methacrylates, the speaker said. These materials are also very resistant to chemicals. In solutions at room temperature the 24-hr. pick-up of water is only $^1/_2$ of 1 percent; the pick-up of gasoline, $^1/_4$ of 1 percent; and of acetone, $2^1/_2$ percent.

Mr. Griffith pointed out that recent developments have produced water-clear materials which are virtually unaffected by ultraviolet light. As compared with plate glass, which transmits approximately 90 percent of visible light, the new purified liquid thermosetting resins transmit about 87 percent in the blue band and are comparable to optical glass in the red band. These optical formulations are now being produced in experimental quantities only, but should find wide acceptance after the war.

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Dr. Marie Bentivoglio of the Development and Research Division of the Celanese Corp., Plastics Division, presented a paper entitled: "The Place of Cellulosic Molding Powders in the Plastics Picture." Highlights of her talk are given in the following paragraphs.

Since the formulation of cellulosic plastics can be controlled by the selection of flake and plasticizer, to meet the requirements of a particular application the speaker stated, it can be said that cellulosic plastics can be custom made to meet the needs of the custom molder. Toughness is one of the properties most sought for in plastics and other structural materials. It may be expressed as the ability of a material to absorb energy and resist permanent deformation, and as the working capacity or energy needed to break a specimen in tension, or in flexure or by impact. Comparative studies made of these standard tests indicate the superior toughness of the cellulosic plastics—especially of the ether, ethyl cellulose.

Unlimited colorability and design in color are another characteristic of the cellulosic molding powders. Of the group, cellulose acetate possesses the best color base and permits a greater degree of conversion into clearer, lighter and more transparent colors. Moisture sensitivity is another property of plastic materials which becomes of practical importance when it causes dimensional change in the molded piece. The dimensional stability of ethyl cellulose was emphasized. The part played by plasticizer content in favoring the tendency to warp was shown.

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Choosing as his topic, "Chemical and Plastic Raw Materials on the West Coast," Dr. G. M. Hebbard, plant superintendent, Los Angeles styrene plant, Dow Chemical Co., outlined reasons why West Coast plastic fabricators are so eager to have a nearby source of plastic stocks, solvents and plasticizers.

In considering materials required for plastics, Dr. Hebbard pointed out that not many important and basic chemicals are now produced on the Coast. Only 12 western concerns of adequate size or with sufficient technical organization are engaged in chemicals manufacture. Only two of these are in the organic field: one with solvents, allyls, alcohols and acetone, and the other with chlorinated solvents. The speaker said that there is a reasonable production of chlorine and caustic, ammonia and synthetic benzene—all basic components of major plastics—but additional highly complicated plants involving considerable expense are required for their conversion to everyday uses.

Because of war production, Dr. Hebbard continued, most eastern plants are considerably over-built now and will, with conversion, have excess capacity for some time to come. In

Other speakers present were: Dr. M. Bentivoglio, G. K. Scribner, W. I. Beach, E. F. Lougee and R. A. Cooper

view of the high initial investment cost per pound of product per year, the need for complicated plants and highly trained technical staffs, there is considerable doubt that industry will be willing to engage in any major chemical expansion on the Coast for some years after the war. The general conclusion is that, although some of the present Coast concerns will enter the plastics raw material picture in a moderate way to obtain markets and experience, we will have to depend on eastern sources of supply for the majority of our basic materials for an appreciable time to come.

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C. W. Blount, of Bakelite Corp., presented a brief paper on "Preheating for Better and Faster Molding." Among the advantages of electronic molding he mentioned the reduction of curing cycles and molding pressures, and a greater range of possible molding materials. To prospective users of the process Mr. Blount suggested: use of $^1/_4$ in. copper screen wire or mica sheets between electrodes and preforms to prevent cooling of preform surfaces; care in regulating flow in deep draft flash molds; allowance for difference in behavior of laminates and plywood from usual phenolic molding materials.

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In a paper dealing with "Some Aircraft Aspects of the Plastics Problem," Carrol C. Sachs, laboratory research analyst of Lockheed Aircraft Corp., reported investigations on the use of the zinc alloy, Kirksite, as an economical tooling material in the molding of plastic airplane parts. The first part of the paper was a fabrication, testing and service report on the use of a transfer mold made of this material for a phenolic hook antenna mast; the second described experiments on the hobbing characteristics of the alloy in connection with the production of a transfer mold for a plastic stub antenna mast; A full report of this speech will appear in an early issue of MODERN PLASTICS.

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The development of "Plastics in Aircraft Tooling" was the subject discussed by W. Brandt Goldsworthy, plastics engineer, Douglas Aircraft Co., Inc., Long Beach Div. Mr. Goldsworthy stated that the tremendous upswing of aircraft production has necessitated extensive research to offset the critical shortage of materials and experienced personnel in toolmaking. An outstanding result of this research is the emergence of plastics as a prolific and relatively simple means of producing aircraft tooling. Of the basic plastics tested, the speaker said that three types have proved most satisfactory: phenolic casting resins, phenolic laminates and ethyl cellulose hot melts.

Current lack of skilled labor in the construction of jigs and fixtures has, in large measure, been met by the use of phenolic casting resins which require fewer man-hours in their construction than metals. The speaker said that difficulties encountered in their application, because of the resins' curing shrinkage and after shrink, and inability to stand shop handling without fracturing, were overcome by pouring the asbestos-filled casting resins into master plaster molds.

The application of ethyl cellulose hot melts, Mr. Goldsworthy continued, is one of the most amazing developments in the entire program. Originally conceived as a casting material for jig bases, nesting blocks, etc., its unusually high impact strength led to its utilization for drop hammer punches. From an analysis of such facts, Mr. Goldsworthy continued, it seems obvious that although plastic tooling had its inception under the press of wartime production, it will have a greater future after the war.

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Under the subject of "Furfural Resin Adhesives for Aircraft Use," John Delmonte, technical director of Plastics Industries Technical Institute, discussed studies made at the Institute Laboratories on characteristics and applications of these resins. During recent years these experiments have been concerned chiefly with two grades of furfural resin adhesives. These are: 1) a high-temperature setting resin designed largely for bonding metals and the pretreatment of certain plastics; and 2) a low-temperature setting type which is used especially for plastics, although it has also been applied successfully as a bond for natural rubber, some synthetic rubbers and wood. The speaker also included in his paper A.S.T.M. data on the physical properties of this resin in its fully cured state and the results of dry and wet strip shear tests performed in accordance with Army-Navy aircraft plywood specifications. Much of the material in this talk has already appeared in a paper by Mr. Delmonte published in the March issue of MODERN PLASTICS under the title "New Developments in Furane Resins."

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Charles F. Marschner, Plastics Division, Consolidated Water Power and Paper Co., presented a paper entitled: "High Strength, Low-Pressure Molded Paper-Base Laminates." His discussion dealt chiefly with investigations on plastics structural aircraft components made during the past four years by the Forest Products Laboratory in cooperation with several private organizations in the plastics and aircraft industries. The principal points of this speech are contained in Mr. Marschner's paper on "Paper Base Laminates in Aircraft" which appeared on pages 81–85 in the March issue of MODERN PLASTICS.

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The present status of plastics was reviewed by Charles Lichtenberg of Monsanto Chemical Co., in a paper titled, "New Plastics Materials." According to Mr. Lichtenberg, the most important influence bearing on plastic raw materials is the increased capacity for the production of certain chemical raw materials in this country. The second important influence is the stepped-up research on plastics which already is benefiting war production. Combined with these influences is the increased competition of plastics with metals and other materials, production of which has also increased. *(Please turn to next page)*

One of the greatest effects in thermoplastics, Mr. Lichtenberg stated, will be the availability of polystyrene for total injection molding. Use of straight cellulose acetate will continue to grow but probably at a slower rate. Cellulose acetate butyrate will certainly continue to grow, the speaker continued. Cellulose nitrate, having reached its peak, will probably continue to be produced at a level rate. The cost picture of vinyl molding materials is not yet clear. If they can be produced within the cost range of present thermoplastics, their physical properties will render them important to the postwar molders.

In the thermosetting group, the relative position of the different materials will probably not change radically, Mr. Lichtenberg said. Phenolic molding materials will remain as the heavy duty thermosetting plastic. Attention has been focused on melamines since they offer advantages of color, dimensional stability, high arc resistance and good weather resistance.

Mr. Lichtenberg said that we can be certain of having injection molding materials that will withstand high temperatures above the boiling point of water. Various modifications of the styrenes will be on the market on a small scale by the end of the war. Nylon has also been discussed as a molding material.

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George K. Scribner, president of the Boonton Molding Co., spoke on "The Molder—Postwar." Stressing the tripled volume of production during the last four years and the increased popularity of plastics, he also pointed out important aspects of planning for postwar business.

Mr. Scribner emphasized the fact that in thinking about postwar plastics, three points should be borne in mind. First among these is the experience of the industry from 1925 to 1935 when there were too many presses, too few customers and such high material prices that the possible field of plastics applications was limited. The result was a fierce competition for the existing business and the reduction of prices far below costs.

A second consideration is the fact that somehow plastics has become the most glamorous of American businesses. There are now 700 molders and 2300 fabricators in the trade, and it has been prophesied that there will be twice that number within two years of the war's end. In conjunction with this increase, the speaker stated, we must all realize that there will be a decided downward curve in the plastics market for at least 6 months after peace is declared.

Mr. Scribner then discussed the third point to be considered in postwar plans: can we build civilian demand back to the level necessary to support triple the postwar volume of plastics production? The future of plastics will lie in its new applications.

The speaker said that it is evident that our machinery and methods can bear improvement. Although the trend of injection machinery is toward larger and larger units, he pointed out that the great need is for a smaller bench type model capable of handling a half ounce at a shot. And cheap, easily replaceable cylinders are needed so that a cylinder for each material or color can be placed beside each machine. Electronic heating should be used with injection molding to reduce the time element and temperature gradient below present levels. Mr. Scribner said that it should be possible to assemble rods, rams and platens at will to fit a given mold and be able to knock it down into its integral parts when the job is finished. The assembly should be such that we could combine various sized top and bottom rams with an immovable center platen, one ram to flow the material, one to open and close the mold. Side rams and pull-back rams should be available.

● ●

W. I. Beach of North American Aviation, Inc., delivered a paper on "The Future of Plastics in Aircraft."

First among factors which may encourage development, Mr. Beach listed the weight-saving effected by using plastics for nonstructural parts such as fairings, cable guards, radio and battery shelves, deflector plates, liners, etc. Mr. Beach said that it has also been found that due to their superior abrasion resistance the thermosetting plastics outwear aluminum and some steels in the case of parts which are exposed to constant rubbing or sharp impact. The corrosion-resisting properties of plastics are sometimes utilized, particularly in the plane interior, to save the weight and cost of the protective finishes. In the case of ammunition boxes, ejection cases and chutes and deflector plates, the resiliency of the thermosetting laminates has proved especially useful, the speaker continued.

In Mr. Beach's opinion, the future of plastics in aircraft will depend on the judicious selection of materials, and greater reductions in weight, cost and production time.

● ●

E. F. Lougee, of the Plastics Industries Technical Institute, presented a paper on "Postwar Markets." The essence of Mr. Lougee's remarks was as follows:

We must choose our markets with a full realization of both the limits and advantages of plastics, Mr. Lougee stated, and with a knowledge of their most economical and practical uses. One of these uses will be found in new homes, in which it seems likely that much more plywood construction will be used than ever before. If prefabricated kitchens and baths gain public favor, there are plenty of molded parts that will fit into this scheme. The success of plastics will depend upon how well molders lay their plans to produce household hardware, plumbing fixtures, bathroom and kitchen accessories along acceptable lines.

Mr. Lougee said that when we entered the war, automobiles, radio and the electrical industry were prime customers of plastics and they will be again. Commercial aircraft and helicopters, if they become as popular as some suppose, will also use plastics. War production has revealed many new economies that will be even more interesting to aircraft manufacturers when they are building in open competition than during the cost-plus days. Refrigerators also offer considerable volume.

Plastics molding, by whatever process, is one of the most rapid methods of manufacturing complete products which industry knows, the speaker continued. Many finishing processes are eliminated and elaborate machining is also done away with. Beyond the conventional housings, knobs and handles, this leads directly to the "gadget" field—a word encompassing a wealth of opportunity that should not be ignored.

Mr. Lougee said that although the industry has had some rather fantastic promotion by feature writers in recent months, this type of imaginative writing has also served to bring plastics into its present enviable and promising position. Furthermore, it will be the means of carrying plastics into the future so that eventually they will be known for what they really are.

● ●

Paul R. Williams, architect and consultant, spoke on the subject of "Plastics in Postwar Construction." Emphasizing the importance of avoiding imitation of other materials in plastics applications, he outlined a number of possible structural uses.

One of the most promising fields for plastics in building, in the speaker's opinion, is the combination of polystyrene with enamels and lacquers. Although plastics alone have a definite place in construction, the opportunities for plastics combined with other materials are much wider. Today's building materials must not only be strong, weatherproof and adaptable to tight assembly, but must also act as sound and heat insulators and have a permanent surface which does not need to be painted.

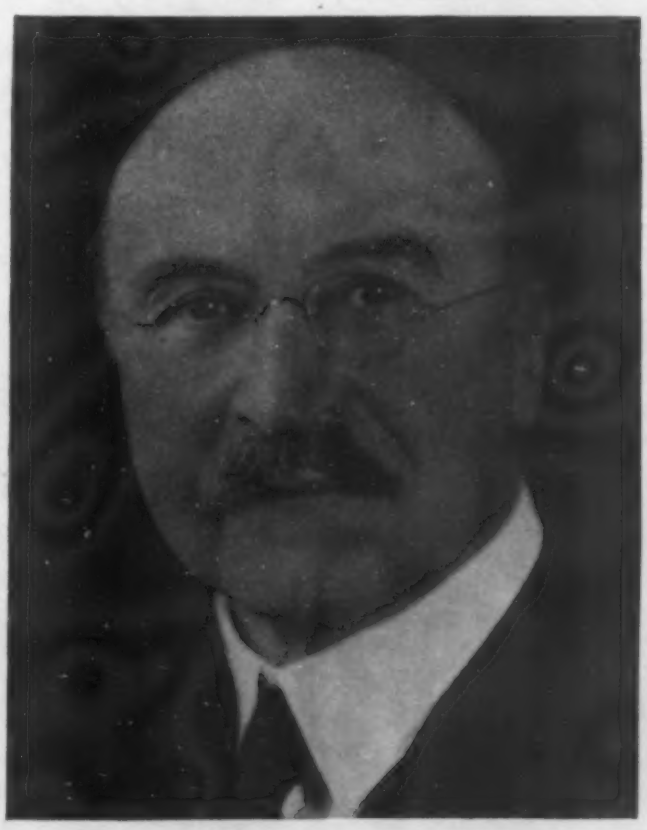
Probably the most hoped-for contribution to the building industry is the prefabricated plastic bath in which tub, shower, toilet, and lavatory comprise a single unit. Prefabricated kitchens in which laminated plywood and plastic sheets could be used for cabinet doors and tabletops offer a mass production outlet. To stimulate thought toward the most profitable uses of plastics for building, Mr. Williams said that a permanent allied plastics exhibit is needed where prospective home owners can see these materials and available applications.

Dr. Leo Hendrick Baekeland

THE death of Dr. Leo Hendrick Baekeland on February 23 brought to a close one of the most important chapters in the development of the plastics industry. It was Dr. Baekeland's work in solving the mysteries involved in the action of formaldehyde upon phenols that resulted in the invention of Bakelite, the first truly commercial synthetic resin. As a result of his research in this line, Dr. Baekeland established practically all the important facts upon which is based the foundation of the present industrial processes of this phenol-formaldehyde compound. Before the publication of the results of his work, there existed not a single industry nor a single application of any importance based on these condensation products. Since the publication of his patents and papers, there have been started here and in Europe numerous factories where these processes are used for the most varied purposes ranging from the manufacture of a self-starter for automobiles to that of transparent fountain pens. The range of products embraces such articles as switchboards for battleships, moldings for cameras, phonograph records, casings for instruments of precision, armatures and commutators for dynamos and motors, telephone receivers, railroad signals, grinding wheels, buttons, pipe stems and articles of ornament.

Dr. Baekeland was born in Ghent, Belgium, on November 14, 1863, and studied at the University of Ghent from which he was graduated in 1882 with the degree of Bachelor of Science. Two years later he was awarded a doctorate of Natural Science, maxima cum laude, by the same university. He taught chemistry at the University and at the Higher Normal School in Bruges until 1889 when he was awarded first prize in chemistry in a competition among the alumni. It was because of this prize, which entitled him to a traveling scholarship, that Dr. Baekeland came to the United States in 1889.

Before leaving Ghent, Dr. Baekeland had become deeply interested in photography. Upon his arrival in this country he became active as a research chemist and his work in the field of photographic paper resulted in the invention of Velox, a paper which utilizes a special colloidal chloride of silver, enabling it to be exposed and developed rapidly and very conveniently. The Nepera Chemical Company, which he founded, manufactured Velox until this photographic development was sold to the Eastman Kodak Co.



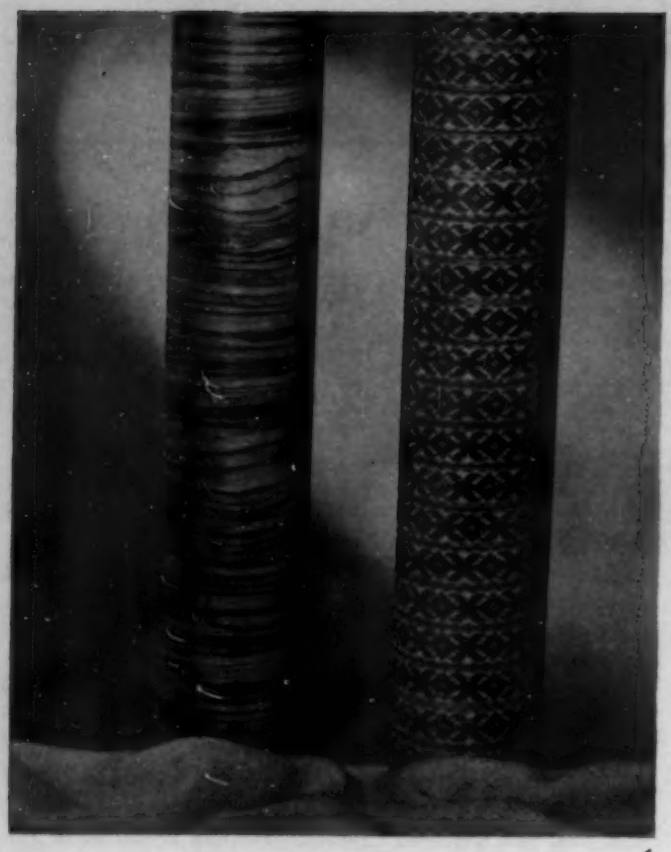
DR. LEO HENDRICK BAEKELAND 1863-1944

Dr. Baekeland next turned his attention to electrochemistry. Impressed with the developments in this field since his student days, Dr. Baekeland spent a winter at the Technological Institute at Charlottenburg, Germany, in the electrochemical laboratory, in order to freshen his knowledge of the subject. Upon his return to America he equipped a modest private laboratory at his home in Yonkers, N. Y. His attention was soon directed to the production of an artificial varnish from a mixture of phenols and aldehydes. In 1906, from experiments with carbolic acid and formaldehyde, he procured a hard, insoluble, unmeltable resin unsuitable for the preparation of varnish but, he decided, capable of becoming a new material which could be formed into useful articles. Patents for Bakelite, as the new resinous material was named, were subsequently granted and the General Bakelite Company (later the Bakelite Corporation) was organized in 1910. Dr. Baekeland continued as the company's president until his retirement in 1939.

In the first World War, Dr. Baekeland was a member of the Naval Consulting Board and the Nitrate Supply Commission, and in 1917 he was chairman of the committee on patents of the National Research Council. He was president of the American Chemical Society in 1924 and was also a former president of the American Institute of Chemical Engineers and the American Electrochemical Society.

Many honors were bestowed upon Dr. Baekeland during his lifetime. Both the W. H. Nichols and the Willard Gibbs Medals were awarded to him by the American Chemical Society, and he received the Chandler Medal from Columbia University, the William Perkin Medal from the Society of Chemical Industry, the John Scott Medal of the Franklin Institute, and the Pioneer Trophy of the Chemical Foundation. He was decorated an officer of the Legion of Honor of France, the Order of the Crown of Belgium and was a commander of the Order of Leopold.

Dr. Baekeland was the first Chandler lecturer at Columbia University on the occasion of the fiftieth anniversary of the School of Mines in 1914 and was an honorary professor of chemical engineering at the University since 1917. He was United States delegate to the International Congress of Chemistry in 1909 and was president of the Inventor's Guild as well as of the American Institute of Chemical Engineers.



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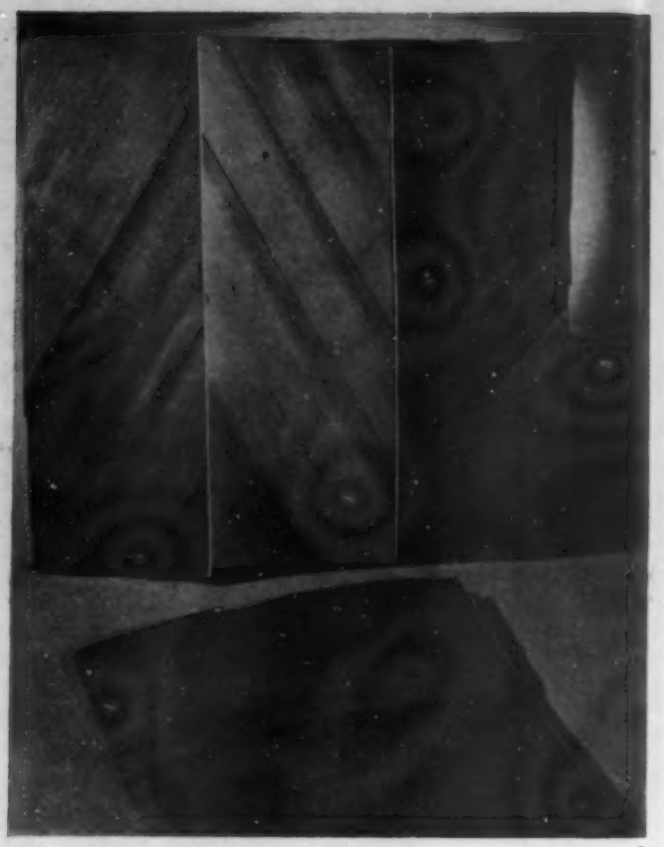

2

1—Two types of decorative plywood developed to conceal unsightly piping and columns and to improve drab interiors. 2—To obtain maximum strength of a sheet of veneer, panels are edge-glued with adjoining grains at right angles.

Convolute winding of plywood tubing

ACROSS the desk of the developer of a new type of resin-bonded plywood tubing flows a steady stream of letters. They come from oil companies, soap manufacturers, architects, camera houses and plantation owners, and most of them are concerned with postwar uses for this patented process.

Like countless other recent developments, this convolutely wound tubing was initiated by a wartime emergency. About a year ago the War Production Board applied to a New York hardwood veneer manufacturer for a plywood container for high-test gas to replace the former, critical metal container. After studying the records of a number of different winding methods, this company concluded that they all entailed too much manual labor. The need was for a process which would make it possible to secure any desired strength or combination of strengths of the wood without the use of new machinery or the addition of hand operations. The method which finally was developed involved winding the plywood veneer at right angles to a mandrel rather than spirally.

It is a well-known principle that the maximum strength of a sheet of veneer is obtained by assembling successive panels so that the grain in one runs at right angles to that in the preceding and succeeding panels. Modern edge-gluing machines already were in use for that purpose. The next step was to feed such a pre-assembled strip convolutely into a mandrel. By making the length of every component panel equal to the circumference of the tube, each successive full wind around the mandrel would have the grain running at a right angle to that of the layer above and below it. The most appropriate machine for winding the veneer was found to be the type employed in the manufacture of resin-impregnated paper tubing.

The principal problem was to discover a method of getting tension when the veneer is first introduced into the mandrel and, at the same time, to prevent that tension from pulling the edge-glued panels apart. "At the time I was puzzling this out," explained the inventor, "a group of us were watching paper wind onto one of the machines employed in the manufacture of resin-impregnated paper tubing. While we stood there, the answer was staring us right in the face." That solution was to let the veneer ride into the mandrel as a passenger on a continuous strip of resin-impregnated paper. In this process, several winds of the paper, which is of approximately the same width as the veneer strip, are fed into the mandrel to secure the necessary tension. The veneer is then introduced over the paper—the tension created in the paper achieving a tight initial wind for both layers. Once the veneer starts winding, the pressure factor can be maintained by the feeder and tension rolls of the machine.

Since the heat in the mandrel activates the resin in the paper, this single operation provides for both the necessary initial pressure and the resin-bonding process. Extra winds of paper at the beginning of (*Please turn to page 170*)

PRODUCT DEVELOPMENT

DIFFERENTIAL MICROPHONES (FIG 1) WHICH eliminate most ambient sound while clearly transmitting wanted sound, yet are small enough to fit over a field operator's mouth, are the latest addition to scientific warfare. Known in the Army as Model T 45, these lip microphones are built for accurate performance under a gas mask.

The microphone itself measures only about $1^1/_4$ in. square and $^1/_4$ in. thick, and can be worn over the upper lip. Within the microphone is a single diaphragm both sides of which are supported between two identical cavities completely enclosed in a case molded from a lightweight phenolic material. The plastic case has 2 small apertures, one at the front, toward the lips, and one at the back, away from the lips. Each aperture is fitted with a moisture-sealing polyvinyl chloride acetate membrane only 0.0004 in. thick, through which sound may enter. The microphone operates on the principle that the voice of the wearer enters the front hole with greater intensity than it enters the rear hole. All other noises come from a greater distance than the wearer's voice and, as a result, enter both holes with the same intensity. The microphone is so constructed that it will respond only to sounds which enter the two sides unequally. A harness of polyvinyl chloride acetate that fits snugly over the operator's ears holds the microphone in place.

Credits—Material: Bakelite, Vinylite. Membrane processed by Electro-Voice Mfg. Co. Harness by S. Buchsbaum & Co. Case molded by Northwest Plastics, Inc., for the United States Army Signal Corps.

TRI-METROGON MAPPING, A NEW AND SPEEDY Army procedure of charting, is a system of aerial photography which, when projected on a transparent cellulose acetate sheet (Fig. 2), shows stipulated contoured intervals of a given area. Perfected to facilitate the mapping of air routes over as yet uncharted areas, this method employs three cameras mounted in an airplane. One camera points directly downward, the others obliquely right and left so that flying parallel lines spaced at 15-mile intervals and at 20,000 ft. above datum, planes can photograph 20,000 sq. mi. in 4 hours. This is in distinct contrast to other existing methods of mapping which are slow, arduous and ofttimes hazardous.

As soon as they are processed, the contact prints are sent to a Compilation Unit where flight lines are plotted on maps showing all identifiable surface points. These same points are noted on the photographs and on a base map made of cellulose acetate sheet. After flight lines are plotted, they are diverted onto strips convenient for plotting and tested for angle of tilt, degree of overlapping and reconciliation of fixed surface points. A rectoblique plotter converts oblique photo angles to true horizontal angles. The position of each common point is marked on the plastic sheet and the directions deter-

1

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3 4

PRODUCT

mined. The master map is reduced photographically and traced on other cellulose sheets. Culture, ridge lines and drainage are drawn on separate transparent plastic sheets of different colors, and the combined superimposed to produce a 3-color chart. These maps are then printed on water resistant paper, in ink that responds fluorescently to instrument panel lighting in an airplane.

Credit—Material: Lumarith.

IN NON-COMBATANT MANEUVERS THESE PLASTIC and glass hatch enclosures (Figs. 3, 4) shield tank commanders from blinding snow and rain, and give great freedom of vision. These enclosures now are standard equipment for use on all tanks when they are not in battle. The unit consists of two separated panes of shatterproof glass at the front; two side portions or wings glazed with transparent cellulose acetate sheet, a defrosting element and a windshield wiper. The enclosure fits directly over the tank hatch in such a way that the occupant is able to see ahead and to either side, and at the same time be protected from the elements. Certain designs permit the tank hatch cover to close on top of the unit. In others, a canvas hood replaces the hatch cover which is merely thrown back on its hinges so as to be out of the way when it is not in use.

The use of non-shattering cellulose acetate sheet for the two side wings instead of heavy shatterproof glass has effected a great saving in over-all weight of the unit without sacrificing either protection or visibility. Since the plastic windows are installed by means of a flexible rubber molding, they can easily be removed when replacements are necessary.

Credits—Material: Fibestos. Manufactured and assembled by Hunter Sash Co., Inc.

LIGHTER LOADS FOR ARMY PLANES AND SAVINGS in precious man and machine hours have been effected by forming drinking water breakers (Figs. 5, 6) from resin-impregnated fabric. The new laminated containers, which have a capacity of approximately 5 gal., entirely eliminate costly operations such as spinning the ends and welding.

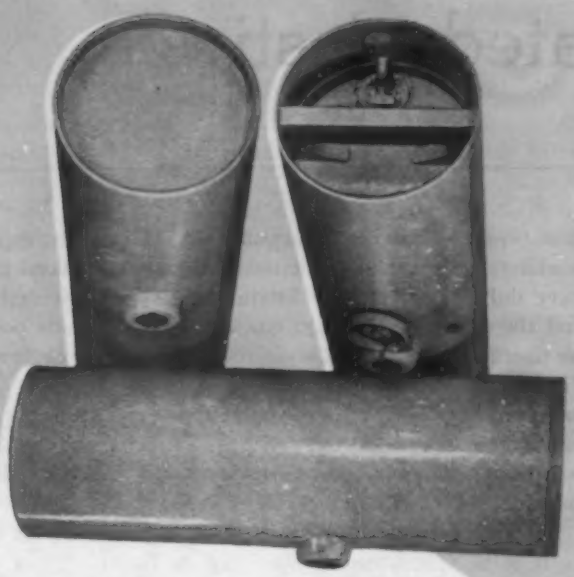
The forming process is comparatively simple. Almost any size container can be built up by a special flexible tube winding machine on which the impregnated fabric is rolled under heat and low pressure. Metal fittings are cemented to the tank with the same thermosetting resin which serves as a bonding agent. The result is a light, waterproof container which can take hard knocks.

Credits—Material: Laminac. Fabricated by Crosley Marine.

LIST ON A SHIP CAN HAVE DANGEROUS CONSEquences when the vessel is caught in a heavy sea. To check this condition, clinometers are installed aboard combat vessels by the Navy Bureau of Ships to indicate the number of degrees of inclination to right or left. In operating principle, the instrument is a relatively simple device. It consists of a free-swinging, weighted pointer mounted in such a manner that it indicates on a scale the degree of list. When trimming ship during the loading of supplies or during the distribution of ballast, this instrument provides a valuable guide.

The base and dial of the new clinometer represent one of the latest war applications of plastics. To meet rigid Naval specifications the manufacturers of these instruments drew on their long experience in the production of thermometers, barometers and similar units. An extra strength phenolic material seemed to provide the most satisfactory results provided shrinkage could be controlled sufficiently to maintain accurate calibration of the dial. This problem was solved through accurately planned mold design and careful molding with the use of special cooling fixtures. While a certain amount of shrinkage was naturally encountered in spite of the use of these fixtures, the piece was so designed that shrinkage would be uniform. In this way accuracy of calibrations was maintained within a fraction of a degree, thus meeting Navy requirements.

Figure 7 shows the clinometer, whose base and dial are compression molded in one piece of black canvas-impregnated phenolic material. The figures and calibrations of the dial are engraved in the mold, and filled in with white paint after molding. The bold contrast thus obtained makes the dial legible even under adverse lighting conditions. A metal insert molded into the base provides the means for suspending



5

DEVELOPMENT

the weighted pointer which is mounted on a grease-sealed precision ball bearing so as to swing freely. Once installed the instrument requires little or no further attention.

Credits—Material: Bakelite. Molded by Chicago Molded Products Corp. for Fee and Stemwedel, Inc., for use by U. S. Navy Bureau of Ships

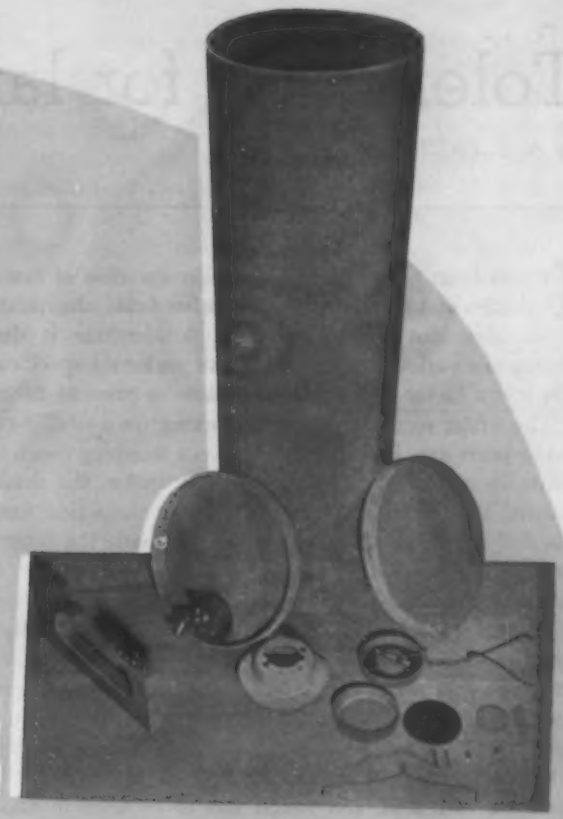
TOMPIONS OR STOPPERS (FIG. 8) FOR THE muzzles of ships' guns while they are not in action seem, at first glance, too unimportant a factor to concern a busy Ordnance Bureau. Yet it is attention to just such detail that assures a smooth functioning Navy. These plugs are essential in keeping gun muzzles and barrels free from moisture, dust and weather, and ready for immediate action.

Before plastics were adapted for this use, gun muzzles were protected by wood or cork plugs and covered with a canvas hood. Cork, however, absorbed moisture, and wood deteriorated too readily. Metal was unsuitable because of its tendency to corrode. Plastics, therefore, with their resistance to salt water and the elements, and imperviousness to grease and oils, proved the logical materials for this purpose.

These 3-, 5- and 6-in. tompions are molded of a phenol-formaldehyde resin in single-cavity dies on 500-ton semi-automatic presses, at 4500 to 5000 lb. per sq. inch. A temperature of about 310° is maintained throughout the molding cycle which requires about 8 minutes. The square holes are formed in the sides of the tompions by cores pulled horizontally from the part before ejection. A metal insert for a fastening stud is molded integrally. To control the adjustment of the tompion, a brass expander is also molded in.

Tightening the wing nut in the center of the tompion expands two small brass bushings against the inside breech of the gun, holding the stopper securely in place. The loosening of the nut contracts the expander and releases the tompion. A neoprene bushing, which fits in a groove under the rim, pushes the tompion against the gun muzzle to form a seal that is weathertight, yet easily removed in emergencies.

Credits—Material: Durez. Tompion for 3- and 6-in. gun molded by Eclipse Moulded Products Co., tompion for 6-in. gun molded by Taylor Manufacturing Co. for R. Perlick Brass Co.



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Tolerances for laminated plastics

by A. B. EASTMAN*

IT has been our experience that in the case of laminated plastics and no doubt in many other fields, the question of limits does not always get the consideration it deserves among the various items that go to make up specifications. Yet it is a factor which can often cause or prevent difficulties.

The writer recalls that when working on a drafting board many years ago, it was customary as a finishing touch to add limits in completing a drawing. Naturally, the draftsman wanted to be sure there would be no complaint from the assembly department later on, and he made the limits very close without realizing the extra costs and possible delays that would be involved in meeting such precise specifications.

That this practice is still being carried out is evidenced by some of the examples which are encountered occasionally. Only recently we saw limits of ±0.002 in. on the spacing between holes intended for wood screws where later it developed that $^1/_{64}$ or $^1/_{32}$ in. would have been permissible. Another example was a rejection due to a 0.005-in. limit on the diameter of a 2-in. rod which was to be used in making a part that finished $1^7/_8$ in. in diameter, and on investigation we found that $^1/_{64}$- or $^1/_{32}$-in. limits would be satisfactory.

Inexperienced designers often needlessly increase the cost of laminated stock and fabricated parts by specifying unnecessarily close tolerances, since the manufacturer naturally allows for increased manufacturing costs, more expensive tools, higher inspection costs and possible rejections and delays when such precision is demanded. Often essential orders requiring fast delivery are delayed because the close limits specified make it necessary to give the job to a skilled and experienced operator. In these days such men are among the minority in most plants and have more work than they can possibly handle. Practically all aircraft companies working on the mass production of military and naval planes have duly considered the limitations of inexperienced help and the decreased cost and quicker deliveries made possible by liberal limits, and show on their prints a clause reading: "Unless otherwise specified, all limits ±$^1/_{64}$ in., or ±$^1/_{32}$ in., and even ±$^1/_{16}$ in." Unless one has worked as an inspector or supervisor, it is hard to realize the incalculable value in speed-up of fabrication, tool making and inspection due to such a commonsense handling of limits.

Of course, it is sometimes almost as serious to omit limits as it is to specify unnecessarily close limits. Quite often after an order has been completed, a complaint is received that the hole specified as $^1/_4$ in. is too tight and should have been large enough to take a $^1/_4$-in. diameter rod freely, or is too loose and should have been a drive fit on a $^1/_4$-in. rod. Or it is said that the outside diameter of a washer or disk should have been slightly undersize to drop into a 2-in. recess or should have been a little oversize to be a push fit. Such information is most helpful if it accompanies an order, but obviously is of no value after the order is completed.

Everyone realizes that there is likely to be some variation in the sizes of one lot of parts as compared with a previous lot. This holds true for metal as well as for plastics. Where laminated plastic parts are ordered for use in an assembly, it will often pay to take the added precaution of sending one of the mating metal parts with each order as a gage, in addition to whatever specification is shown on the print. Quite often complaints are made that parts are too tight or too loose, and investigation shows that the last shipment of metal mating parts received by the customer, one of which was used as a check gage, ran slightly larger or smaller than the previous lot.

In specifying limits on a drawing of a part machined from laminated plastic, it may be advisable to exclude the thickness of the material itself. Standard or N.E.M.A. limits, as they are called, have been adopted by all manufacturers of laminated plastics.[1] Since extra costs are involved for grinding, or grinding and resurfacing, to limits closer than N.E.M.A., it is economical to use standard thicknesses.

In specifying limits on the diameter of holes, it is well to bear in mind that tapped, drilled and punched holes are inclined to be slightly undersize when standard drills, taps and punches are used. Any limits that would require special

* Assistant plant manager, Continental-Diamond Fibre Co.

[1] A list of these limits can be obtained from the manufacturers or from the National Electric Manufacturing Association at 155 E. 44th Street, New York City.

TABLE I.—PERMISSIBLE VARIATIONS IN SIZE OF PIECES CUT FROM STANDARD SHEETS

Nominal thickness, in.	*Permissible variations in length or width, ±, in.*		
	6 in. and under	*6 to 24 in.*	*24 in. and over*
0.010 to $^1/_4$, incl.	0.010	0.015	$^1/_{32}$
$^{17}/_{64}$ to $^1/_2$, incl.	0.012	0.017	$^1/_{32}$
$^{33}/_{64}$ to 1, incl.	0.015	0.020	$^1/_{32}$
$1^1/_{64}$ to $1^1/_2$, incl.	0.018	0.030	$^1/_{16}$
$1^{33}/_{64}$ to 2, incl.	0.022	0.040	$^1/_{16}$

TABLE II.—PERMISSIBLE VARIATIONS IN WALL THICKNESS OF LAMINATED TUBES

	Permissible variations, ±, percent							
	Rolled tubes				*Molded tubes*			
		Grade LE			*Grades X, XX, XXX, L, LE, A*			
Nominal wall thickness, in.	*Grades X, XX, A*	*$^3/_{16}$ to $^1/_2$ in., inside diameter*	*Over $^1/_2$ in., inside diameter*	*Grades C, AA*	*$^1/_8$ to $^1/_4$ in., incl., inside diameter*	*Over $^1/_4$ to $^1/_2$ in. incl., inside diameter*	*Over $^1/_2$ in., inside diameter*	*Grades CE, AA*
Under $^1/_{16}$	0.006	0.010	0.008	not made	0.008	0.008	0.008	...
$^1/_{16}$ to $^1/_8$, excl.	0.007	0.011	0.009	0.015	0.011	0.011	0.011	0.015
$^1/_8$ to $^1/_4$, excl.	0.009	0.013	0.011	0.020	0.017	0.015	0.011	0.020
$^1/_4$ to $^1/_2$, incl.	0.011	0.015	0.013	0.020	0.025	0.018	0.013	0.020

drills, taps or punches may involve extra costs and longer deliveries. Where tolerances on drilled holes are close enough to require reaming, time and expense can often be saved by ordering such holes slightly undersize and having the reaming operation performed by the user in order to get the exact fit required in assembly of parts which may show some variation in size. When drilling deep holes, the drill is inclined to run out, so that some variation may occur in center distances between the top and bottom surfaces. This runout is more evident when drilling parallel to the laminations, an operation to be avoided whenever possible.

Where holes are counterbored in standard sheet stock, the variation in thickness allowed by N.E.M.A. limits will show up either in the depth of the counterbore or in the thickness of stock left below this counterbore. The drawing should designate which of the two dimensions should be held, if there is any preference. The same rule applies to blind holes and in either case, generous tolerances will help production.

Fabric base tubing is inclined to run slightly undersize on inside diameter and tolerances (*Please turn to page 166*)

TABLE III.—PERMISSIBLE VARIATIONS IN THICKNESS OF LAMINATED SHEETS[a]

Nominal thickness, in.		*Permissible variations, inches*					
Fraction of inch	*Decimal equivalent*	*Grades X, P, XX, XXX, XXP, XXXP, A*[b]	*Grade C*	*Grade CE*	*Grade L*	*Grade LE*	*Grade AA*
		Plus or minus	*Plus or minus*	*Plus or minus*	*Plus or minus*	*Plus or minus*	*Plus or minus*
0.010	0.010	0.002	...	...	0.003	...	...
0.015	0.015	0.0025	...	...	0.0035	0.0035	...
0.020	0.020	0.003	...	...	0.004	0.004	...
0.025	0.025	0.0035	0.0065	0.0065	0.0045	0.0045	...
1/32	0.031	0.0035	0.0065	0.0065	0.005	0.005	...
3/64	0.047	0.0045	0.0075	...	0.0055	0.0055	...
1/16	0.0625	0.005	0.0075	0.0075	0.006	0.006	0.018
3/32	0.094	0.007	0.009	0.009	0.007	0.007	0.018
1/8	0.125	0.008	0.010	0.010	0.008	0.008	0.020
5/32	0.156	0.009	0.011	0.011	0.009	0.009	...
3/16	0.1875	0.010	0.0125	0.0125	0.010	0.010	0.024
7/32	0.219	0.011	0.014	0.014	0.011	0.011	...
			Plus only		*Plus only*		
1/4	0.250	0.012	0.030	0.015	0.024	0.012	0.028
5/16	0.3125	0.0145	0.035	0.0175	0.029	0.0145	0.034
3/8	0.375	0.017	0.040	0.020	0.034	0.017	0.038
7/16	0.438	0.019	0.044	0.022	0.038	0.019	0.044
1/2	0.500	0.021	0.048	0.024	0.042	0.021	0.048
1/2	0.625	0.024	0.053	0.027	0.048	0.024	0.058
3/4	0.750	0.027	0.058	0.029	0.054	0.027	0.068
7/8	0.875	0.030	0.062	0.031	0.060	0.030	0.076
1	1.000	0.033	0.065	0.033	0.065	0.033	0.086
1 1/8	1.125	0.035	0.069	0.035	0.069	0.035	...
1 1/4	1.250	0.037	0.073	0.037	0.073	0.037	0.106
1 3/8	1.375	0.039	0.077	0.039	0.077	0.039	...
1 1/2	1.500	0.041	0.081	0.041	0.081	0.041	0.124
1 5/8	1.625	0.043	0.085	0.043	0.085	0.043	...
1 3/4	1.750	0.045	0.089	0.045	0.089	0.045	0.144
1 7/8	1.875	0.047	0.093	0.047	0.093	0.047	...
2	2.000	0.049	0.097	0.049	0.097	0.049	0.160
2 1/4	2.250	...	0.105	...	...	...	...
2 1/2	2.500	...	0.113	...	...	...	...
2 3/4	2.750	...	0.121	...	...	...	...
3	3.000	...	0.130	...	...	...	...
3 1/2	3.500	...	0.146	...	...	...	...
4	4.000	...	0.163	...	...	...	...
4 1/2	4.500	...	0.179	...	...	...	...
5	5.000	...	0.190	...	...	...	...
5 1/2	5.500	...	0.210	...	...	...	...
6	6.000	...	0.230	...	...	...	...
6 1/2	6.500	...	0.240	...	...	...	...
7	7.000	...	0.260	...	...	...	...
7 1/2	7.500	...	0.280	...	...	...	...
8	8.000	...	0.290	...	...	...	...
8 1/2	8.500	...	0.310	...	...	...	...
9	9.000	...	0.320	...	...	...	...
9 1/2	9.500	...	0.340	...	...	...	...
10	10.000	...	0.360	...	...	...	...

[a] On sheets of nominal thickness not listed in this table, the permissible variations shall be the same as for the next greater thickness.

[b] The minimum thickness for grades XXP, XXX, and XXXP is 0.015 in., and for grade A is 3/64 in. Grades P, XXP and XXXP are not available in thicknesses over 1/4 in.

PLASTICS IN REVIEW

1 This waterproof right-angle flashlight with a switch control on top for easier manual operation when clipped to the belt, was designed by Dohner and Lippincott for the Allbright Electric Co. Molded by Chicago Die Mold Mfg. Co. of Tenite II, this light boasts a sturdy molded plastic belt clip. Requiring 14 fewer parts than its predecessors, the light will withstand a 24-hr. immersion in water because of the fact that its 2 batteries are sealed in the battery housing. By extending the length of the battery housing, the model may be made a one-, two- or three-cell flashlight

2 These transparent compar tubes of extruded Resistoflex, when filled with mercury are used by aircraft manufacturers so that the behavior of airplane instruments during test flights may be observed and recorded by motion picture. The tubes are abrasion resistant and maintain their temperature stability under extremes of heat or cold—properties which are highly essential to their use in this capacity, since test flights subject a plane and its parts to the most severe conditions of flying

3 These two Tenite collets, slotted and tapered to fit into the ends of a standard gage holder, represent a new metal replacement. To facilitate resetting, the shoulder of the collet is notched for an end wrench, and a thin slot running along its length takes up slack in the locked position. Two shallow flat surfaces on the taper provide for dimensional adjustment under pressure. The use of a plastic for these collets prevents scratching or burring of the gaging surface, thereby allowing most of the gage's length to be used. The collets are a product of the Turner Gauge Grinding Co.

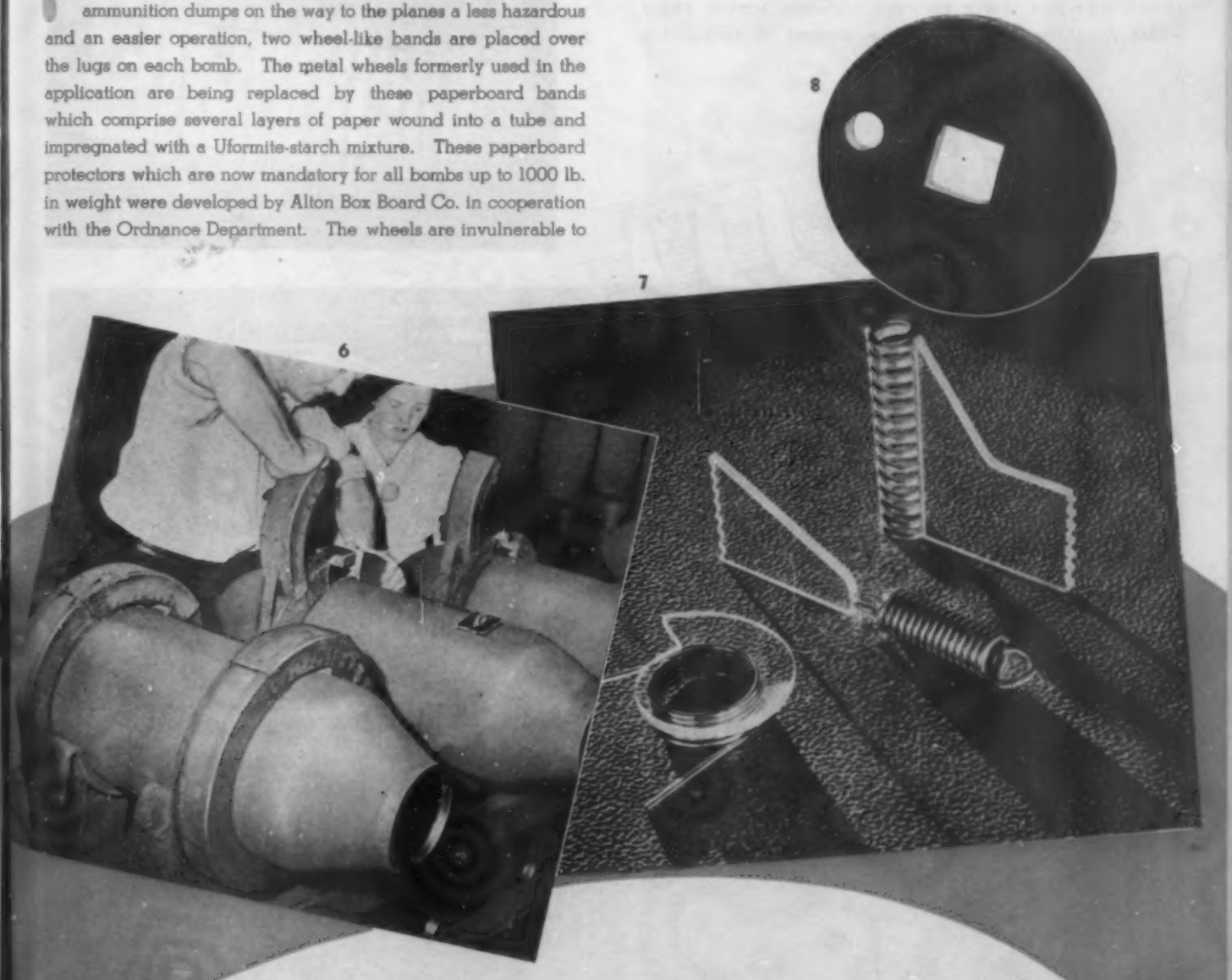
4 In an effort to put every square inch of space in our fighting planes to good account and at the same time to lighten the plane load, the Army Air Corps has adopted this collapsible Krene canteen manufactured by the National Carbon Co., Inc. The 0.012 in. thick material is die cut and then sealed around the edges with a solvent which is set by heat and pressure to insure the canteen against leakage

5 Crystal clear Lucite bowls are a basic feature of a new sight feed bubbler for indicating gas flow in industrial lines. Able to withstand 100 percent greater line pressure than glass, the Lucite bowls provide maximum visibility of the bubbling process and have high resistance to breakage. The indicator, developed by Meriam Co., and injection molded by the Chicago Molded Products Corp., is described as fundamentally a purging medium with its widest application to date in conjunction with tank liquid level gage operation. The bubblers are made in two types. The ring type is recommended for pressures of 100 p.s.i. while the strap type is advised for pressures of 50 lb. per square inch. A gasket of neoprene seals the union between the bowl and the metal assembly containing inlet and outlet connections

6 To make the transportation of bombs from the factory to the ammunition dumps on the way to the planes a less hazardous and an easier operation, two wheel-like bands are placed over the lugs on each bomb. The metal wheels formerly used in the application are being replaced by these paperboard bands which comprise several layers of paper wound into a tube and impregnated with a Uformite-starch mixture. These paperboard protectors which are now mandatory for all bombs up to 1000 lb. in weight were developed by Alton Box Board Co. in cooperation with the Ordnance Department. The wheels are invulnerable to severe weather conditions and lose less than 3 percent moisture resistance after sustained immersion, according to standard test made under actual conditions of transportation

7 Plexiglas is employed in an unusual application by the Hunter Pressed Steel Co. to demonstrate various characteristics of springs. Examples are pressure diagrams made of this transparent material to record specifications graphically and to reveal simple errors which may represent serious faults in performance. Because its refractive index precludes distortion and its edges transmit light, Plexiglas has been found to be ideal for this purpose. Interesting lighting effects that heighten advertising values are also made possible by the use of this material

8 A disk of fine canvas-base Bakelite directs the discharge of the extinguishing agent in a new fire extinguisher for planes manufactured by American-La France Foamite Corp. Pressure-tightened against the valve body by the gas, the plastic disk, a product of Spaulding Fibre Co., Inc., prevents leakage and insures ease of operation. Use of non-metallic material in the disk eliminates the possibility of the part freezing to surrounding metal during operation or of the disk corroding



Studies in lighting fixtures

A PAINSTAKING program of research, study and experiment is a necessary concomitant of new or improved end-uses of plastic materials. One materials manufacturer has recently conducted a survey of the field of fluorescent lighting, in the course of which some interesting facts and figures were compiled and the cellulose acetate lighting fixtures on these pages developed as working models for purposes of study and discussion.

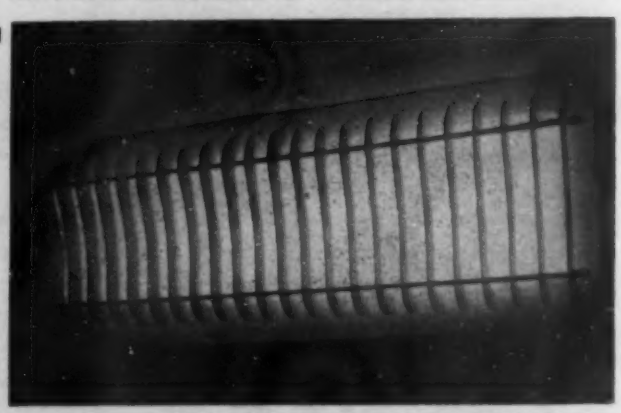
A review of recent fluorescent history shows that sales and performance figures were impressive in all industrial and in some commercial fields, but negligible in consumer fields. In 1938, only 200,000 tubular lamps were sold, whereas five years later sales had swollen to 33,000,000—an increase of 16,700 percent. The success of the lamps can be fairly laid to their high efficiency—they provide an economical and dependable source of light. A cool (the heat seldom exceeds 110° F.) 100-watt fluorescent lamp yields 4200 lumens or about $2^1/_2$ times as many as its incandescent counterpart. And its useful life is roughly 3000 hrs., or more than twice the lifetime of an incandescent lamp.

Despite its astonishing industrial progress, fluorescent lighting has made little headway in consumer fields. By nature cold and unsympathetic, the light's indigenous blue-greens and purples must be modified if they are to be rendered pleasing to the public eye. And the fixtures, necessarily large, have through inept design been made to look coarse and cumbersome, as if they had not yet been properly adapted to gracious living. But both handicaps—color and bulkiness—can be overcome when a return to peacetime production stimulates fixture manufacturers to use suitable materials in a more appropriate manner.

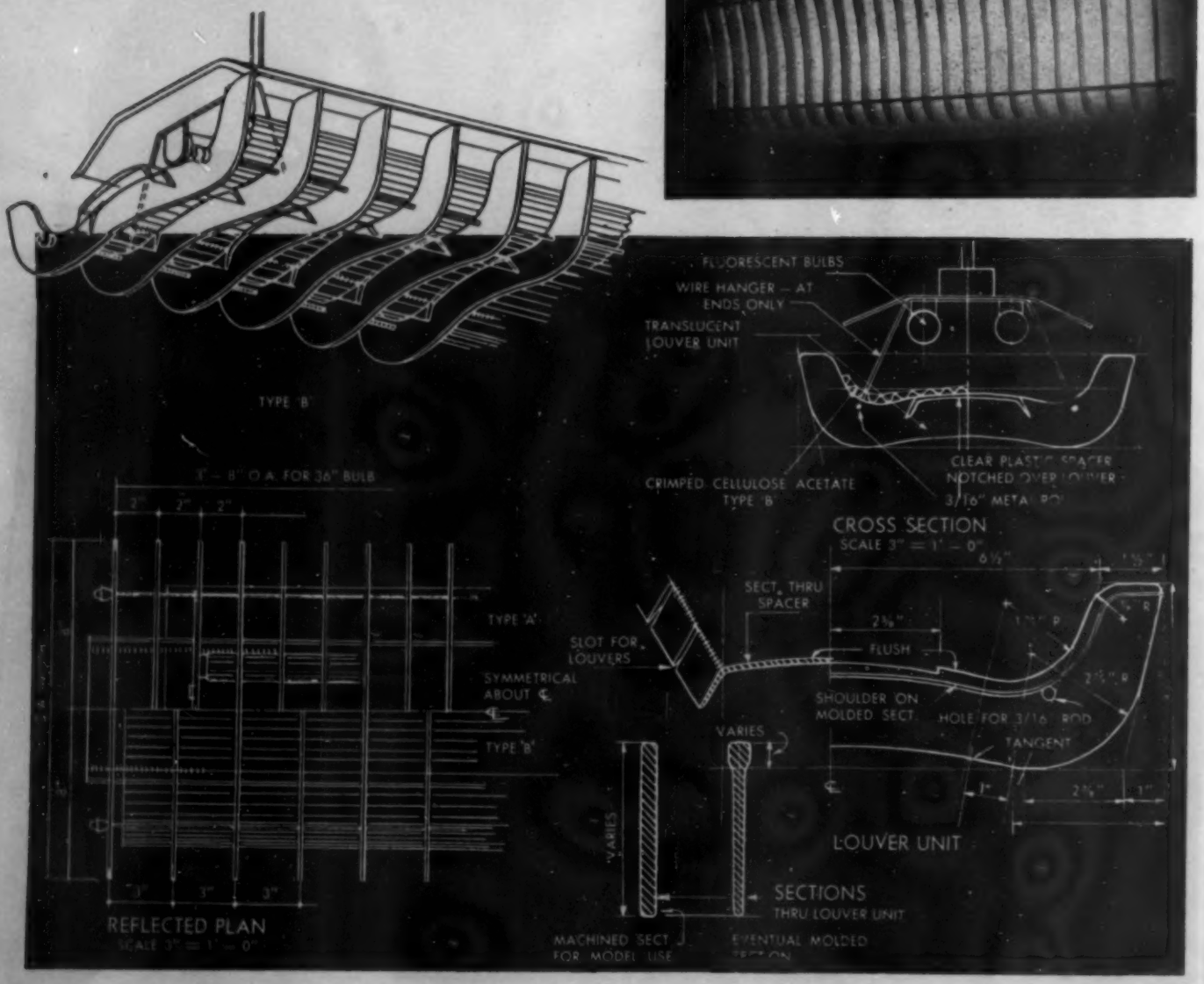
Traditional materials—metal and glass—have hitherto

PHOTOS, COURTESY CELANESE CELLULOID CORP. DRAWINGS BY MORRIS SANDERS

1



1—Specially suited for corridors and stairways, the fluorescent fixture at right is designed to create an effect of continuous length. The accompanying drawing shows a section of the extruded cellulose acetate strips which form the louvers and the method of suspension



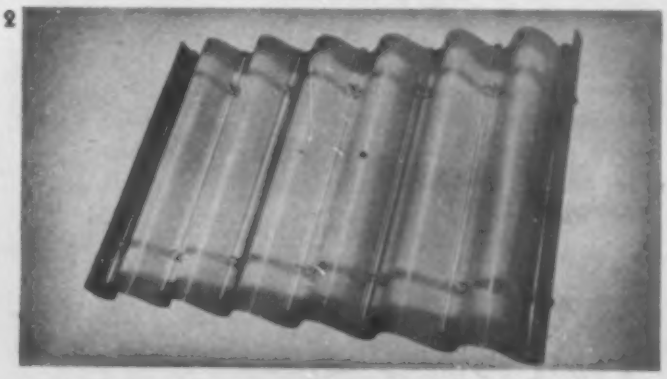
failed to render fluorescent lighting generally acceptable to the public, and badly designed plastic fixtures have added nothing to its popularity. There were, for example, several unhappy prewar instances of manufacturers using plastics in their flimsiest and cheapest forms as lightweight substitutes for flat and cast glass. Realizing that the postwar consumer market for fluorescent lighting is extensive, manufacturers of lamps and fixtures alike are now preparing themselves for a more thoughtful approach.

The lamp manufacturers are making admirable progress. The war's end will find fluorescent lamps higher in efficiency, lower in cost, and more varied in form. There will be a wide choice of sizes (lamps ranging from 6 to 60 in. in length), a small variety of colors, and a few curved and flat forms. Despite these improvements, the lamp will need the full assistance of cooperative materials men and fixture manufacturers if it is to satisfy most commercial requirements. Restaurants, shops, stores, super-markets, public rooms and institutions make specialized demands of lighting that transcend mere functional performance. Color, warmth, scale, enhancement of merchandise and surroundings, and light and shade composition are among the requirements of commercial lighting outlets. And, of course, domestic demands for sympathetic lighting are even more stringent. The lamp has not as yet been successfully studied in terms of consumer needs—for kitchens, bedrooms, bathrooms, stairways and corridors, wall brackets and porch lighting.

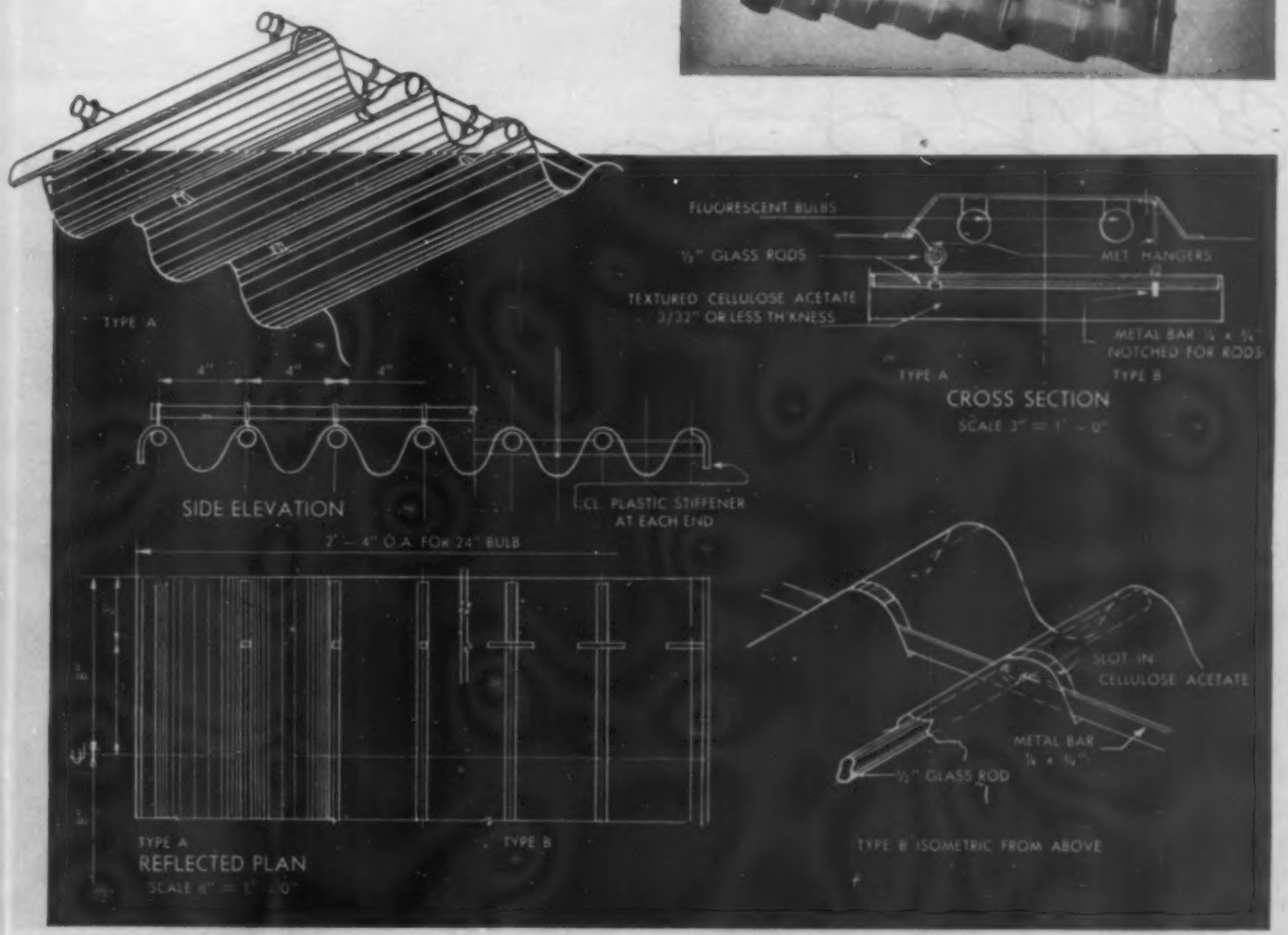
In designing lighting fixtures of cellulose acetate, consumer reactions and needs were first weighed and then coupled with the advantages of simplified production and flexible end-application. It is the feeling of the company and its product development adviser, who designed the fixtures, that no group of materials or combination of groups of materials approach thermoplastics in their adaptability to fluorescent lighting requirements. Color is a major factor in all lighting, and in this respect plastics are outstanding since they can be colored to almost any tint. Because the color is inherent in the plastic, the light transmission is excellent, approximating up to 92 percent in the case of transparent sheets.

For variety, composition and styling, the tough extruded pieces can be interlaced, crimped or pleated, in combination with glass or metal, to form an infinite variety of interesting

2



2—Corrugated cellulose acetate sheet resting on glass rods slipped through molded acetate rings forms the sample fixture shown at the right. The accompanying blueprint contains side elevation, reflected plan and cross section views of this same fixture. The finished drawing at the top and left of this print indicates the appearance of the fixture when installed



and distinctive designs, some with embellished logotypes and others with attractive motifs suitable to the application. The important factor is that the extruded bands and shapes make feasible economical large quantity production of plastic lighting fixtures.

The light weight and lack of brittleness of the acetate material are, of course, its outstanding advantages in such applications as lighting fixtures. Distribution savings are marked, since packing, mailing and shipping costs are considerably less than those of glass, and loss due to breakage is reduced to a minimum. Relamping and cleaning are speedier and easier, in some cases requiring only that the fixture be "pinched" out of the frame and then snapped back into position. For mobile units such as buses, airplanes, trains and cars, where cuts from flying glass are frequently the cause of injury and death, the application has obvious and important significance.

The designs shown here must be considered as illustrations of the complementary services of thermoplastics to fluorescent lighting rather than as finished pieces. In this respect they are points of departure for architects and men in the lighting field who plan to use plastics in the postwar period.

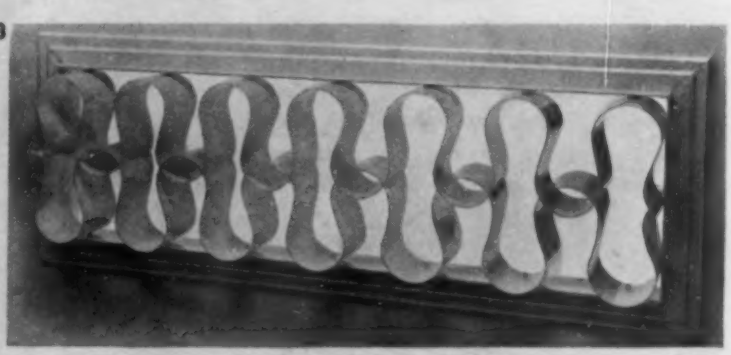
The fixture shown in Fig. 1, designed to create an effect of continuous length, is especially suited for corridors and stairways. The extruded strips of cellulose acetate which form the louvers are held in place by metal rods, covered with extruded plastic tubing which makes them almost invisible, and finished off with plastic bushings. The lining of the fixture is made of acetate sheet.

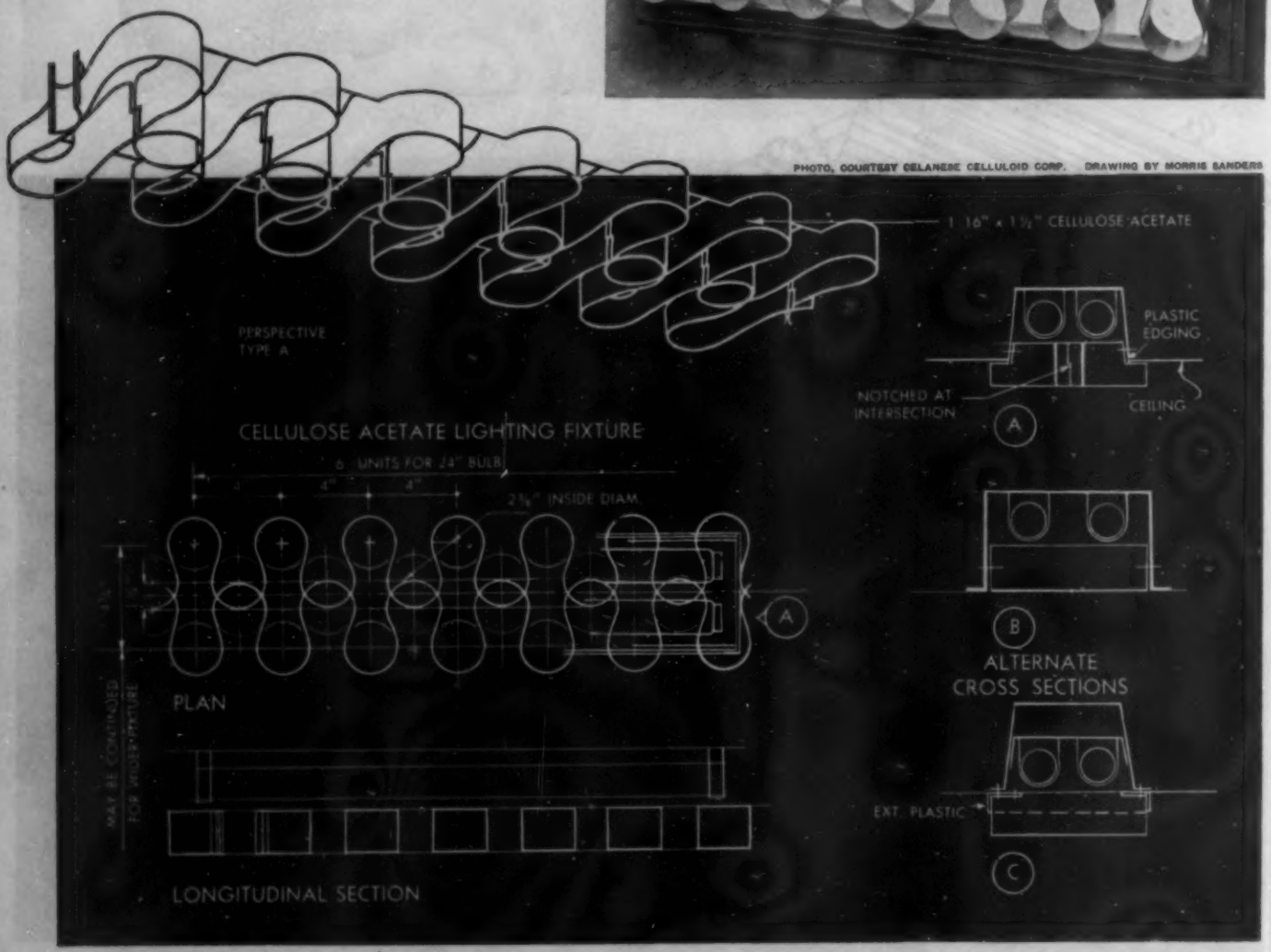
A corrugated sheet of the plastic, $^{3}/_{32}$ in. or less in thickness, rests on glass rods slipped through molded acetate rings to form the fixture shown in Fig. 2. Plastic stiffeners reinforce both ends of the sheet. Interwoven strips have been used in Fig. 3, attached by plastic hardware to a frame which has been fabricated of extruded acetate architectural molding.

Lamp fixture manufacturers who have seen these working models and with whom the subject has been discussed are of the opinion that the introduction of these plastic fixtures is a definite step forward in fluorescent lighting development. Many, however, having individual ideas about design, color and application, will undoubtedly carry the development to such conclusions as their particular problems dictate.

Credits—Material: Lumarith. Designs for fluorescent fixtures by Morris Sanders.

3—*In this design for a fluorescent lighting fixture interwoven strips of cellulose acetate are attached by plastic hardware to a frame which is fabricated of extruded acetate molding. The blueprint includes plan, longitudinal section and alternate cross sections of this design*





PHOTO, COURTESY ARMY ORDNANCE EXHIBIT OF WAR WEAPONS, CHRYSLER BLDG., NEW YORK CITY

The M-52 trench mortar fuze

As the plastics industry enters its third year of war work, it is appropriate to review, from an engineering angle, one of the most important military applications of plastics—namely, the M-52 trench mortar fuze.

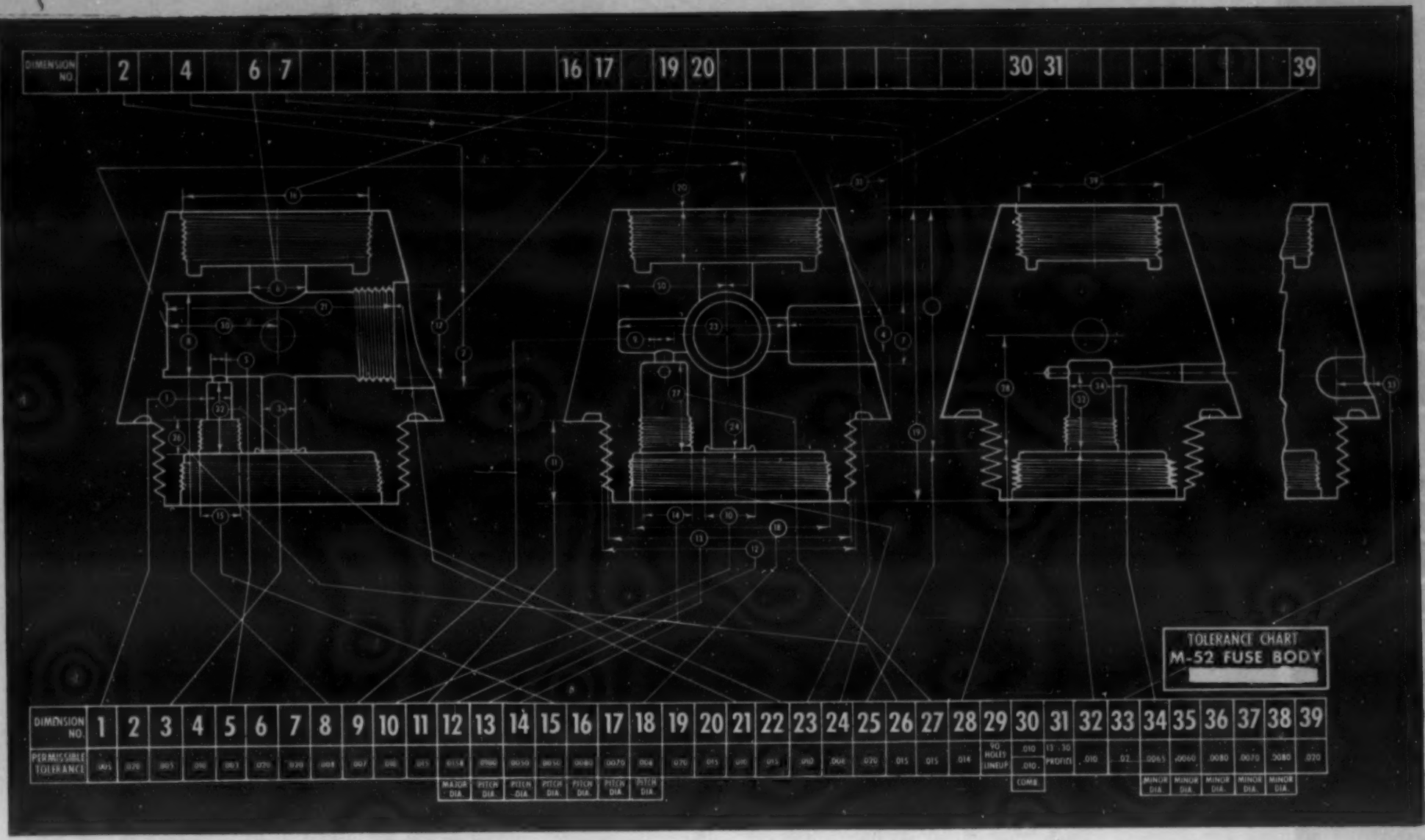
Plastics are today being used in the manufacture of a sizable percentage of the millions of these fuzes which are being turned out for Army Ordnance. A majority of the molders handling the work are not only delivering their allotted number of fuzes but are manufacturing these parts with less than 5 percent rejections for all reasons—rejections made, incidentally, by the molders' own inspection departments. At present, many molders are in full production on this item, which they consider one of their better jobs, and are now engaged in stepping up their production.

To procure a complete story on the production of the plastic fuze, the writer visited the plants of its larger producers to watch, at first hand, the development of this part through the successive stages from the manufacture of the preforms to the final packing of the finished product. The photographs on these pages, especially taken for MODERN PLASTICS, illustrate the more interesting points of the molding operation employed in the production of these fuzes.

At Chicago Molded Products Corp. in Chicago, Ill., a very complete setup was found which includes several 8-cavity mold units with mold layouts as shown in Fig. 3. It will be noted that while there are 8 cavities in this mold setup, as many as 10 spare cavity assemblies are employed. The operation is arranged so that at the same time that 8 cavities are in the hands of the disassemblers and assemblers, a second set of 8 cavities is in the press for curing operation. While transfer molding is used in all the plants that were visited, the actual application of this method varies somewhat from plant to plant.

At Chicago Molded Products Corp., one transfer pot and plunger is used for each cavity (Fig. 3). The material is a medium-impact black phenolic, 140 flow—one preform being used for each pot. A preform-loading fixture is used mainly to eliminate the possibility of double loading in one pot. The preforms are preheated in a steam oven at 280° F. for a total length of one cycle or $5^1/_4$ minutes. The weight of the preform, which is 60 grams, must be exact. As another check on the material, the batch number on each drum is noted carefully before the plastic is used.

The plungers and pots use 60 lb. of steam pressure which



DIMENSION NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
PERMISSIBLE TOLERANCE	.005	.029	.005	.010	.003	.020	.020	.008	.007	.010	.015	.0158	.0100	.0050	.0050	.0080	.0070	.004	.020	.015	.010	.015	.010	.004	.020	.015	.015	.014	90° HOLES LINEUP	.010 .010	15° 30° PROFILE	.010	.02	.0065	.0060	.0080	.0070	.0080	.020
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2—On the 4 sections of the M-52 trench mortar fuze body which are included in this drawing are shown all the constructional details. The 39 different tolerances indicated at the top and bottom of the blueprint are evidence of the accuracy demanded in the production of the fuze bodies. Permissible tolerances are given without their dependent dimensions. Molders familiar with this part will be able to visualize the approximate over-all dimensions to which each tolerance applies

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give a temperature of approximately 280 to 290° F., and the yoke or chase uses 120 lb. of steam, giving 310 to 320° F. This higher temperature for the yoke is necessary inasmuch as the cavities have a chance to cool off somewhat during the disassembly operation. The molder states that if the steam pressure on the plunger and pot is only a few pounds below 60, this lower heat causes an undue strain to be exerted on all affected parts. This condition causes undue tool breakage, especially on the threaded rings which are used to mold the external threads on the fuze body. A steam pressure above 60 lb. causes a premature setting of material in the pot and results in spongy molded pieces. This higher pressure also increases the danger of cracking pots, sinking cavities or cavity sections since the material sets up in the pot and cavity before it has properly "filled out." An increase in the yoke or chase pressure apparently does no damage; a decrease causes poor filling out as well as tool breakage and a "cold" appearance of the molded parts.

For the molding cycle the cavities are loaded into the yoke—care being taken that locking keys do not come out of place. Then the cavities are set properly. However, if any difficulty arises, they are removed from the yoke for inspection. In the next step the preforms are loaded into the transfer pots, and the mold is closed under low pressure. After the mold has been under low pressure for 30 sec., "high" pressure is applied. The curing time is set at 3 min. after the mold is completely closed. Under no circumstances should parts be cured for a longer or shorter period of time because, under such circumstances, certain tolerances will be exceeded and the parts rejected. After 3 min., as recorded on the timer, the press is opened. Plungers and pots are cleaned, disk and sprue removed from the plunger, and the cavity assemblies carefully eased toward the back of the press where the operator on the first disassembly fixture slides them into a chute. At this point the mold operator or helper must be sure that a brass rod is passed through the 8 sprue holes in the pots to guard against a sprue remaining in one of the holes. The molder states that this is one of the more important safety features in the whole operating cycle since a sprue inadvertently left in a sprue hole will almost assuredly

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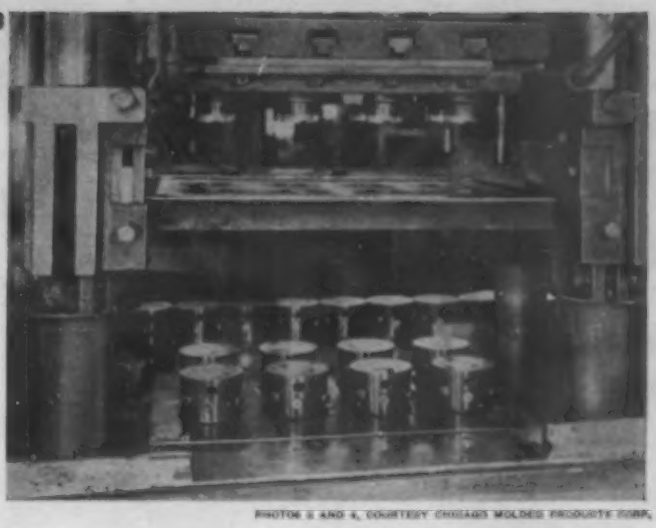

PHOTOS 3 AND 4, COURTESY CHICAGO MOLDED PRODUCTS CORP.

3—Each fuze mold at Chicago Molded Products Corp. will accommodate 8 cavities which are shown here ready to be taken from the press and dismantled for the removal of the castings. **4**—*Six operations are required at this plant for the finishing of the fuze bodies. Operator A spins flash from periphery of part using a motor-driven mandrel and hand file, and removes flash from outer edges of side holes with a motor-driven wire brush. Operator B in addition to drilling out the locking pin hole and setback hole also faces the counterbore hole. Operator C drills the firing pin hole and then reams the booster cup hole to size. Operator D trues up the depth of the slider pin hole. Operator E trues up the depth and the counterbore of the safety pin hole and then counterbores the locking pin hole drilled out by Operator B. Operator F uses hand cutter to remove burrs from bottom surface, a stone to remove burrs from firing pin hole edge and a wire brush for burrs in slider hole. Finally she applies air pressure to clean out loose dirt particles and material left in the cavities*

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drawing are shown all the constructional details. The 39 different tolerances indicated at the top and bottom of the blueprint are evidence of the accuracy de-

to visualize the approximate over-all dimensions to which each tolerance applies

PHOTOS 5 THROUGH 8, COURTESY CHICAGO MOLDED PRODUCTS CORP.

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cause a cracked pot, a cracked ring or both. The plunger also may crack or sink into the steam platen thereby causing the entire press to be shut down for major repairs.

Five operators are needed in the molding at each 8-cavity setup. Operators designated as *A*, *B*, *C*, *D*, are responsible for cavity disassembly and assembly. Operator *E* is the molder. With a pneumatic dismantling fixture, Operator *A* pulls core pins from the safety pin hole, the safety wire hole and wrench hole. She also unscrews the top of the unit with the aid of an electrically operated unscrewing bar, and removes the slider hole core pin with a motor-driven wrench. These pins are placed in the wooden trays made for this purpose, which are passed along to one of the assembly operators. Operator *B*, using a pneumatic screw driver, removes core pins from two bottom holes. She also unscrews the end of the bottom plunger from the threaded ring through the use of a power-driven wrench. Operator *C* employs compressed air with a multiple fixture to clean the flash from all details of the mold unit assembly. She likewise removes the molded fuze body from the cavity. Operator *D* reassembles the complete cavity unit and passes it along to the molder at station *E* where it is placed in position in readiness for the next shot.

After molding, the fuze body is sent to the finishing depart-

***5**—In the final inspection at Chicago Molded Products Corp., Operator A uses a duplex electric gage to check the depth of the slider hole and the center distance from slider hole to bottom pad—two extremely critical dimensions. Operator B uses the same type instrument to check the depth of the safety pin hole and the distance from the center of the safety pin hole to the bottom pad. Operator C gage checks the diameter of the locking pin hole and the over-all height of the fuze body. **6**—Other steps in the final inspection are performed by Operator A who uses a triple-duty electric gage to check 1) on the slider hole, distance from counterbore to bottom, 2) on safety pin hole, distance from counterbore to bottom and 3) on distance from bottom pad to bottom rim. Operator B gage checks the pitch diameter of top thread, Operator C gage checks diameter of bottom inside thread and Operator D gives fuze bodies a final visual inspection preparatory to packing*

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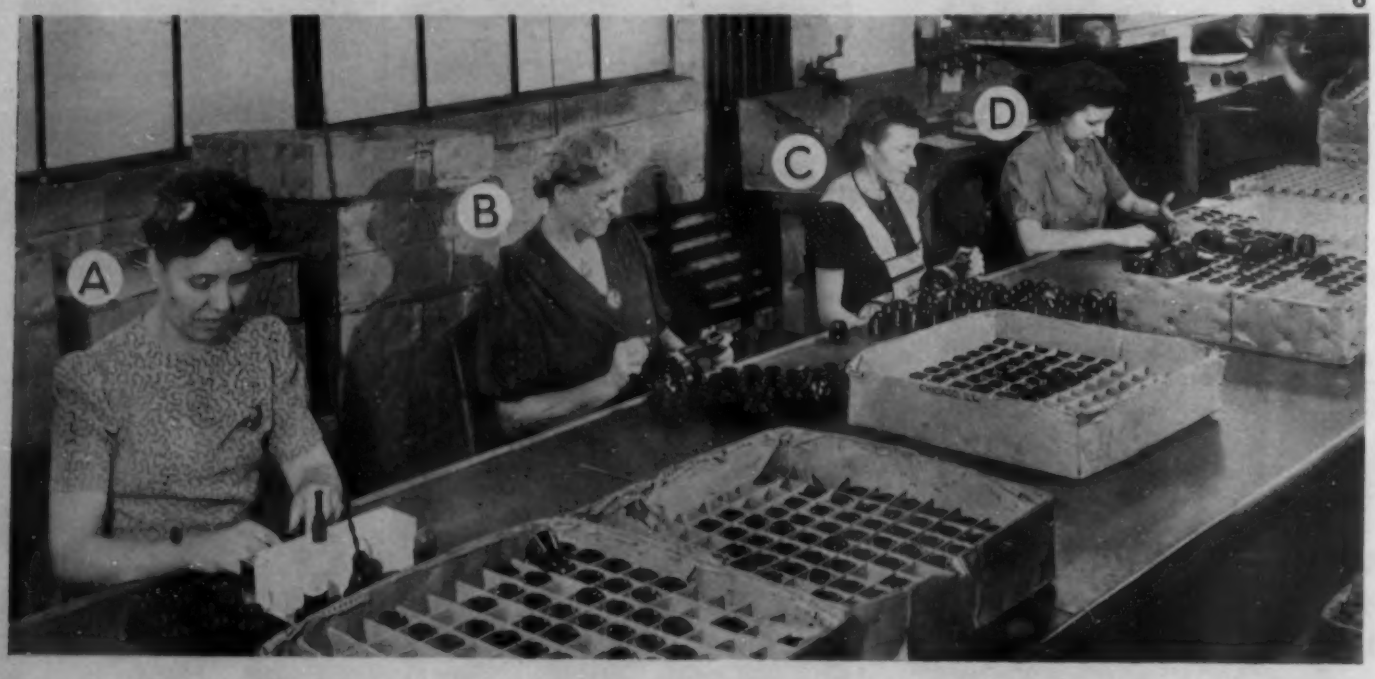

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ment where a through production line of 6 operators completely readies the parts for inspection. Figure 4 shows the production setup for these operations which involve the removing of flash from the outer edges of side holes and outside periphery, the drilling, reaming and truing-up of various depths and diameters, the removing of the burrs, and the cleaning out of all loose dirt particles left from these operations. The parts then are packed in nested boxes and sent to the inspection department for intricate gaging operations.

The first three steps in gaging are shown in Fig. 5. In steps *A* and *B*, highly accurate electrical indicating gages are used—each gage checking two dimensions to their very close tolerances. Position *C* checks the diameter of the locking or safety pin hole and the over-all height of the fuze body. Figures 6 and 7 show seven additional stages in this gaging. A part registering over tolerance at any point is set aside either for rejection or salvage.

So that the rejections at these final inspection and gaging stations may be held to a minimum, a constant check is kept on these parts as they come from the mold. At stated intervals one complete shot is taken from each cavity—not only from the 16 cavities operated in each mold but from the spares as well. These parts are put through a very careful check gaging so that the moment any difficulty becomes evident it can be traced immediately to the one or more cavities at fault. These mold sections are immediately withdrawn from production. A report on the difficulty is sent along to the tool department together with the offending mold parts and the trouble is rectified. Before a cavity is returned to production, a further check is made. The chief inspector has the authority either to permit the cavity to be returned to production again or to return it for further tool work. Figure 8 shows two operators engaged in this very important mold checking operation.

7—Additional operations that are included in the final inspection at Chicago Molded Products Corp. are performed by these 3 employees. Operator A pin-gage checks the depth of the safety wire hole, Operator B checks with a 3-point alignment-gage location of the safety wire hole and Operator C thread-gage checks pitch on the thread of the slider hole. 8—As the fuze bodies come from the molds at this plant, 6 gages are used to check highly critical dimensions. This procedure immediately reveals faulty mold details and makes prompt correction possible

With all these checks and counter-checks in force it is easy to see just why fuze production at this plant has been good. However, this molder emphasizes that before the job was set up in full-scale production a great many difficulties had to be overcome and a large amount of money spent in solving the problems. The experience of the plant has followed the path of most molding jobs—the path which leads from many and devious difficulties to smooth and normal production with few rejects.

The second plant to be visited in the course of this survey was General Industries Co. in Elyria, Ohio. Here again we found a plant in full-scale production, consistently delivering its promised quota of M-52 fuzes. The management has maintained this record from the time 100 samples were originally submitted to Picatinny Arsenal for check through the period of increased production requested this fall.

As they are by all the molders on this job, the fuzes at this plant are transfer molded. In this particular case the molder uses a 4-cavity setup with one transfer pot for each cavity. Figure 9 shows a 4-cavity mold in the open position with the molder removing one of the wedges from a chase with a pair of tongs. The three additional wedges, which can be seen in the forepart of the press, have just been removed from the chase. Another major difference in the mold design at

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9—With a 4-cavity mold in the open position, a molder at General Industries Co. removes a wedge from a chase with a pair of tongs. **10**—*All wedge disassembly operations at this plant are performed by one operator.* **11**—*At the 5-station, through-line finishing setup, all the usual operations of deburring, removing the gate, cleaning and truing up of the holes are accomplished*

PHOTOS 9 THROUGH 15, COURTESY GENERAL INDUSTRIES CO.

this plant is that each chase or wedge yoke is a separate unit and not part of a large chase plate. The use of a single, separate chase somewhat simplifies mold repair work—that is, repair work done to any part of the chase. For instance, if one chase becomes badly scored, thereby permitting one of the side pins to push out too far, this single chase can be quickly replaced. In addition, the use of a 4-cavity mold allows the use of smaller capacity presses than would be possible were 8-cavity molds employed.

All wedge disassembly operations are performed by one operator (Fig. 10). It is possible for this operator during the normal curing time, which is $3^1/_2$ min., to disassemble and reassemble completely the four wedges and have them in condition for reloading in the mold. All pin-withdrawing and unscrewing operations are accomplished with manually operated jigs and fixtures. As the various pins are withdrawn and unscrewed they are placed in a pin-sorting fixture which can be seen in the foreground of Fig. 10. Not only does this fixture obviate the possibility of misplacing any of the smaller parts, but it relieves the skilled operator of the need of keeping his eyes always on his work. Because of the arrangement, he

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12—This setup for the final inspection and gaging of the finished fuze parts is one of the arrangements employed at General Industries Co. 13—It is the duty of this specially trained inspector periodically to gather up complete shots from all sets of wedges and completely gage all dimensions

need merely grasp each pin since he is sure it is in the same position each time.

The transfer pot and plungers as well as the chases are operated at a temperature of 320 to 330° F. Four wedges are in the process of molding while an additional four are being disassembled and reassembled. All preforms are heated for 8 min. in a steam-heated oven held at a temperature of 180° F.

After molding, these parts are taken to a 5-station, through-line finishing setup (Fig. 11) where all the usual operations of deburring, removing the gate, cleaning and truing-up of the holes are accomplished. After finishing, the parts are sent through the final inspection and gaging operations. One such arrangement is shown in Fig. 12. The large number of operators engaged on these inspection and gaging operations gives visual proof of this molder's statement that whereas only 6.6 man-hours are required to finish a thousand fuze bodies, 20.6 man-hours per thousand are needed for the various inspection and gaging operations. However, this molder has found that it is far better to discover any poorly molded parts or parts with dimensions outside the tolerances before completion, for in so doing he is sure that no fuze body will be the cause of a mortar shell not being 100 percent effective.

In order to discover instantly any difficulties which may develop in the molding of this part, one specially trained inspector is constantly on guard with a complete set of gages. His duties demand that he gather up complete shots from all sets of wedges periodically and completely gage each and every dimension. This "check inspection," which occurs just as the parts are molded, is a major factor in reducing the amount of scrap accumulated by the molder in production of this job.

The next plant on the itinerary was The Waterbury Companies, Inc., Waterbury, Conn., which has been in production on this fuze for many months. At the present time, the equipment at the plant consists of four 8-cavity molds with a production capacity of 10,000 bodies per day. As is usual in an arrangement of this type, each 8-cavity setup is equipped with 16 wedges so that 8 of the wedges can be in the press while the second set is being disassembled, unloaded and reassembled for the next shot.

One major difference that was encountered in the molding equipment in this plant involved the construction of the transfer pot. Instead of having one pot for each cavity or two pots for 8 cavities, the setup was designed so that one pot feeds the entire charge of material necessary to fill out all 8 cavities. Figure 15 shows this unique rectangular channel-type pot. The 8-cavity chase with the knockout pins visible and the wedges removed can also be seen in this illustration.

Before the management of Waterbury Companies decided to undertake the production of this most intricate part, a careful study was undertaken. Results showed that while many parts more complex than the fuze are now being molded, few parts call for all of the following factors which are essential in the molding of the fuze:

1. Production on a relatively large scale.
2. A very high number of low-tolerance dimensional specifications.

(*Please turn to next page*)

PHOTOS 14 THROUGH 18 COURTESY THE WATERBURY COMPANIES, INC. 14

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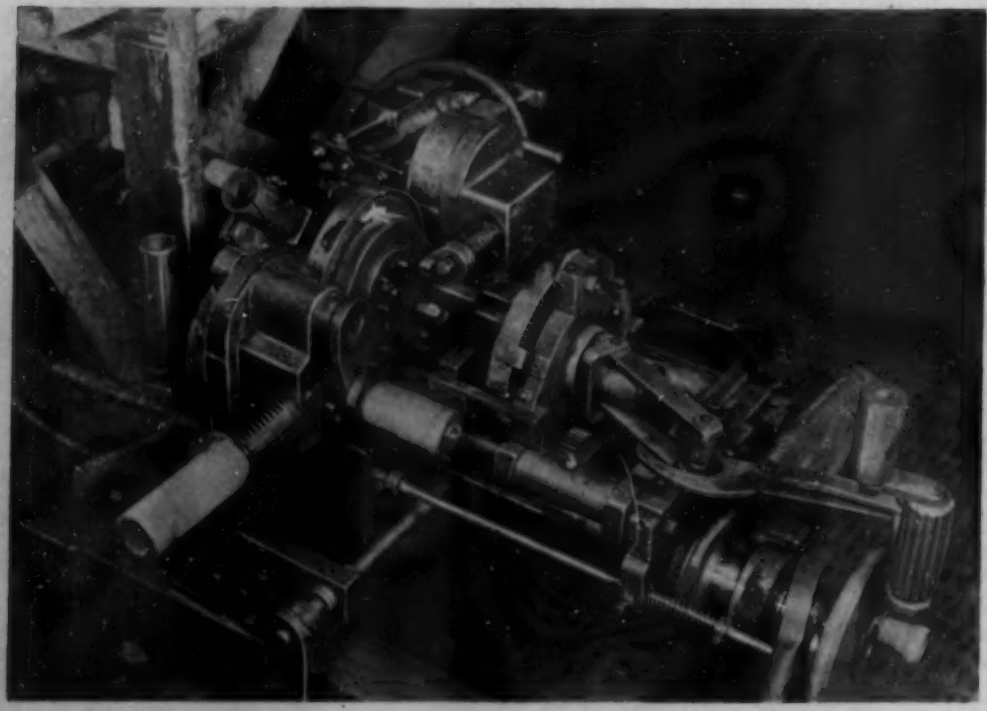
3. High production with a minimum of personnel.
4. Design of essentially fragile molds in such a manner that necessary repairs can be held to a minimum.

It was noted that the larger the number of cavities designed for each setup, the larger would be the expected percentage of rejections. However, due to the economy of labor personnel, it was decided to engineer molds with a capacity of 8 wedges. Transfer molding was decided upon in order to reduce the tendency of the fragile pin members which project almost throughout the entire body of the cavity, to bend or break. Another reason for the selection of transfer molding was that the molded fuze body would be more homogeneous in structure. This company decided that with individual cylinders or pots for each wedge, the mold charges would have to be made exceedingly uniform, and little variation could be allowed in the temperature of the preforms, pots and wedges. In addition, the fit and dimensions of all movable parts would need to be ground to close and accurate tolerance.

With all these considerations in mind, the company decided that a single pot would best fit its needs. However, its engineering department in the initial stages of operation encountered considerable difficulty with this method. It discovered during the first tests that some cavities filled out sooner than others, causing varying densities and, consequently, dimensional variations in the molded parts. The department stated that this condition probably was due to slight variations of temperature at different points of the pot and the cavities proper. Variation of the plasticity of the preforms also was thought to contribute to this condition. In order to overcome this difficulty, an overflow channel was provided in each cavity and the center to center distance of each sprue hole was made exactly the same. The shape and size of the channels or exit gates were determined by cut and try methods, but eventually the problem was solved.

The engineering department came to the conclusion that the most important factor governing the accuracy and tolerance with which fuze bodies were molded was the speed with which the equipment could disassemble, unload and reassemble the wedges. Consequently, considerable engineering effort was exerted in the design of the wedge disassembly mechanism. Figures 16, 17 and 18 are views of this intricate piece of apparatus. With this unit, it is possible for one operator to completely disassemble, remove the molded part and reassemble 8 wedges (one complete shot) and still have some time left over to aid the molder in filling his loading rack with the 16 preforms necessary for each shot.

This machine was designed so that as the side pins, threaded plugs and sleeves are automatically removed from the wedge,



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14—Rectangular pot being loaded with preforms from loading fixture. **15**—*At this plant the mold setup was designed so that one pot feeds the entire charge of material necessary to fill out all 8 cavities. The unique rectangular channel-type pot is shown in this photograph.* **16**—*An over-all view of the wedge disassembly mechanism showing the control knobs and operating handles*

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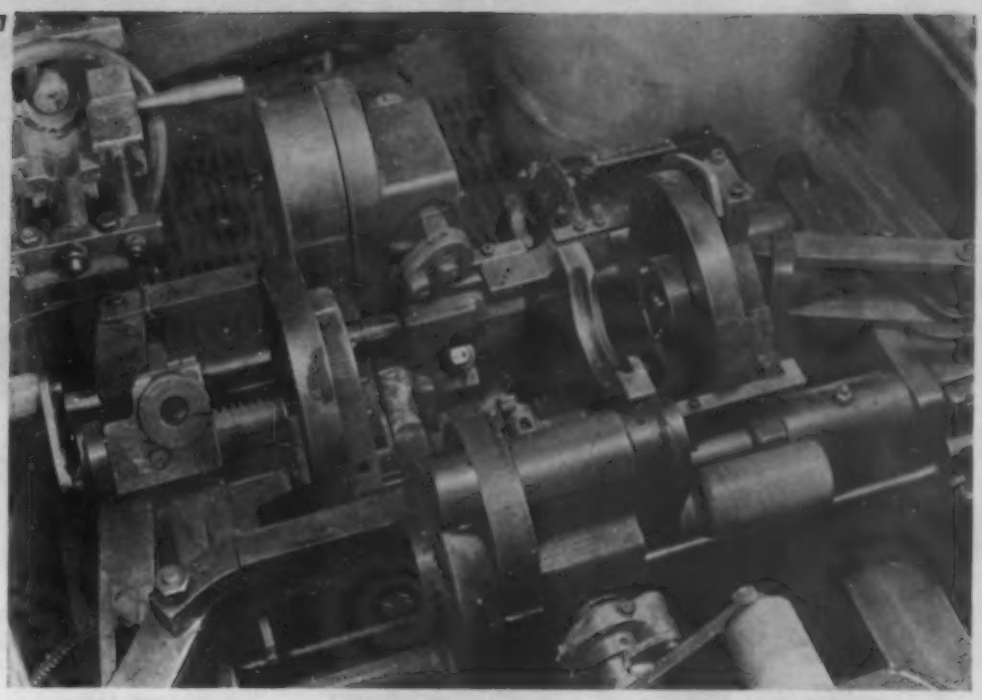

17—This close-up of the wedge disassembly mechanism shows the mounting cradle, and the fingers and spindles which are designed to engage with the 7 detachable cavity sections and pins

at no time do they become disengaged from the fingers of this unit. Rather, they are held directly in position so that as soon as the molded part is removed from the wedge, the mechanism, in reverse motion, completely reassembles all movable parts so that the wedge is again in condition to be loaded in the chase for the next shot. Figure 18 shows the disassembly unit with one disassembled wedge in position. The fuze body has just been removed and all pins, plugs and loose parts are being held in position by the various component parts of this equipment. Some of the motions are actuated manually—others are power operated.

Another interesting factor in connection with production at this plant is that at no time are the preforms preheated except for a slight warming on a hot plate for a very short period. In other words, this single pot setup with exit gates, eliminates the dangers associated with material flow variation.

In this plant, as in others, more man-power is required for the inspection operations than is employed in all the other stages of production. Figure 19 shows a setup of four operators with four drill presses and the necessary drill jigs and fixtures. These operators perform all the finishing operations required for all the parts molded in this plant. One additional operator through the use of a small rotating wire brush, cleans up the slight flash which is encountered on the parting lines. For gaging these parts, the engineering department has produced some unique designs. Figure 20 shows a Rube Goldberg affair which not only gages the large internal thread at the top of the fuze body, but also gages the large external thread which is used to assemble the fuze in the mortar shell. The rotating motion necessary for this thread gaging is produced by a rack and pinion device with the operating handles fastened to the ends of the racks. Each of the additional plug-gaging units, shown in Figs. 21 and 22, gage two side holes at the same time. (*Please turn to next page*)

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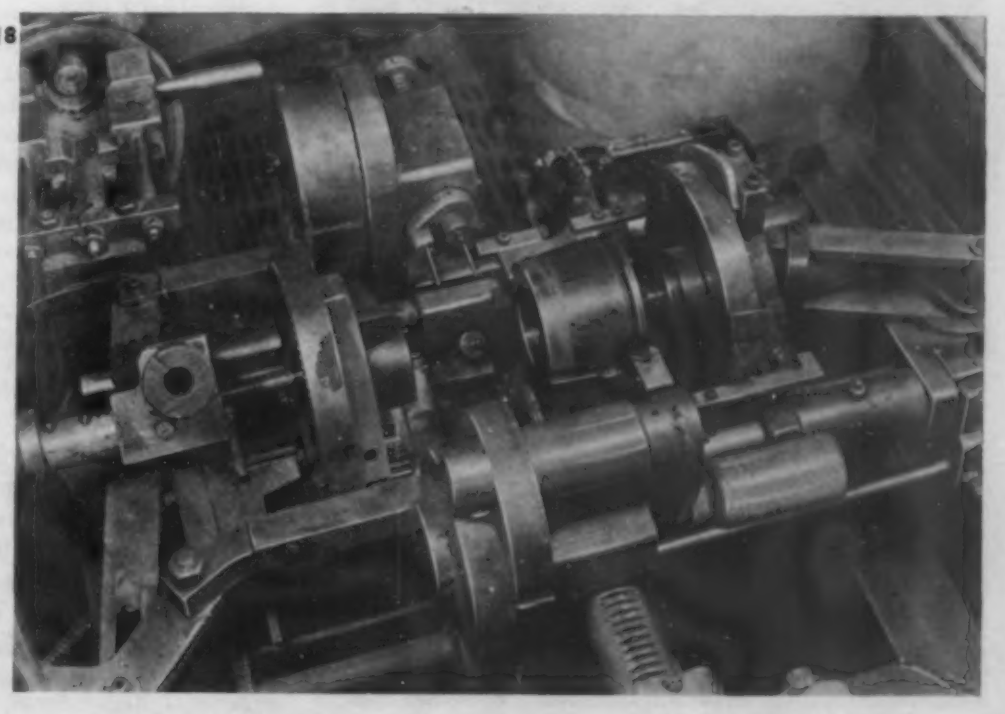

18—This closeup shows the disassembly unit with one disassembled wedge in position. The fuze body has been removed and all pins, plugs and loose parts are being held in position by component parts of the equipment

PHOTOS 19 THROUGH 21, COURTESY THE WATERBURY COMPANIES, INC.

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It should not be assumed from this description that the production of this molder is almost 100 percent perfect and that the company is at no time forced to scrap or perform salvage operations on any quantity of parts. It has been this writer's experience that in molding intricate plastic parts, there has never been a job in which the molder has not, at one time or other, had some trouble. One of the greatest difficulties in plastic molding is that there is a certain lapse of time between the development of a difficulty and the time it is discovered. During this period, many thousands of parts can be produced, and it is common knowledge that in many cases these parts must be scrapped. In order to reduce to a minimum the time between the development of trouble and its discovery, this molder has set up a spot inspection whereby at certain stated intervals, complete shots from all 16 wedges in every mold setup are carefully inspected and gaged. Each wedge has its identifying number so that as soon as any trouble is traced to a cavity it can be taken from production.

As a result of these checks and counterchecks, rejects have been reduced to a minimum. In the opinion of this particular molder the M-52 fuze body is one of his better molding jobs.

The next plant to be visited was the Plastics Division of Joseph Stokes Rubber Co., located in Trenton, N. J. This company has made use of 4-cavity setups, using two operators per press. While the wedge and chase design is similar to that employed by several of the other molders, the transfer setup at this plant is such that one pot delivers the charge for but one cavity. Thus far, the company has been running 6 presses or a total of 24 cavities, and has been operating on a total pot closing and curing time of $4\frac{1}{2}$ min. of which approximately 3 min. is cure time. This timing leaves approximately 75 to 90 sec. for the actual pot closing. During this time there is continuous motion of material, and the

***19**—The finishing operations at The Waterbury Companies, Inc., employ a setup of 4 operators with 4 drill presses and the necessary drill jigs and fixtures. One such group is shown in this view.* ***20**—This fixture operates the gages which check not only the large internal thread at the top of the fuze body but also the large external thread used to assemble the fuze in the mortar shell.* ***21** and **22**—Additional plug-gaging units gage 2 side holes at the same time. A lock-type clamping device (Fig. **22**) holds the body in place in the gaging fixture*

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PHOTOS 23 THROUGH 25, COURTESY JOSEPH STOKES RUBBER CO.

***23**—To obtain maximum results from its high-frequency oscillator, Joseph Stokes Rubber Co. engineered a conveyor system for the speedy transfer of preheated preforms from the oscillator to the particular press station. **24**—A close-up of the electrodes with the preforms just being placed in position for preheating. **25**—Oscillator with power turned on and safety cage closed. The fluorescent bulb is lighted by induction*

cavities are not completely filled out with a homogeneous part until all motion has come to a stop. This long flow is accomplished with a steam pressure of 60 p.s.i. on the pot and 80 p.s.i. on the mold, and a pressure of 5 tons per sq. in. on the material in the pot. The slow pot closing speed is not accomplished by means of a needle valve adjustment in the high-pressure line. It is an actual function of the material flow, the pressure exerted upon the material in the pot and the size of the sprues and gates. An additional time factor in this operation is the press open time which, when added to pot closing and curing time, gives a total cycle of approximately $5^{3}/_{10}$ min., which allows for a total production of 85 heats per 8-hr. shift.

While this molding plant has had some difficulty in holding the parts to size, it has not been alone in this respect. Along with the other producers, the management has been exerting every effort toward two ends: 1) increased production and 2) reduction in rejections. Some time ago the company decided that it had approached the maximum efficiency that would be reached through the use of standard methods of production. Therefore it decided to investigate the advantages which would accrue from the use of a high-frequency oscillator in preheating the preforms. The advantages appeared so definite that no time was wasted in installing a large 15-kw. oscillator. Realizing that further engineering was necessary in order to obtain the maximum results from this new piece of equipment, this company engineered a unique conveyor system (Fig. 23), which makes possible the speedy transfer of the preheated preforms from the oscillator to the particular press station for which they are intended. This conveyor system makes use of a power-driven moving belt traveling approximately 200 ft. per minute. This system is also equipped with a selector device which is operated by the oscillator operator. The operation is as follows: the operator, shown at the extreme left in Fig. 23, preheats the preforms for two charges (8 pills). The preforms for each charge are held in a pallet or tray. After approximately 40 sec. of preheating, one loaded pallet is placed on the moving belt. The delivery station is determined by the selector which causes the loaded pallet to be shunted from the main belt and allowed to slide down whichever delivery chute has been determined for this charge. The second loaded pallet is immediately started on its way. The speed of this belt is so great that the elapsed time between preheating and loading into the transfer pots is very small. The same

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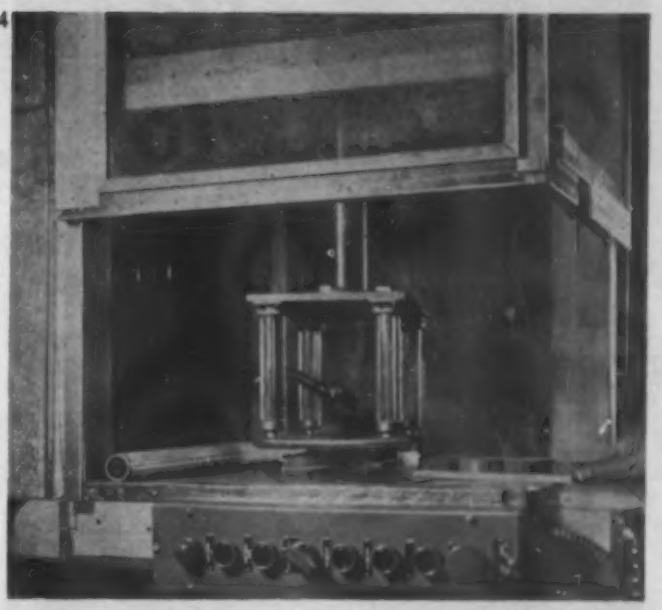

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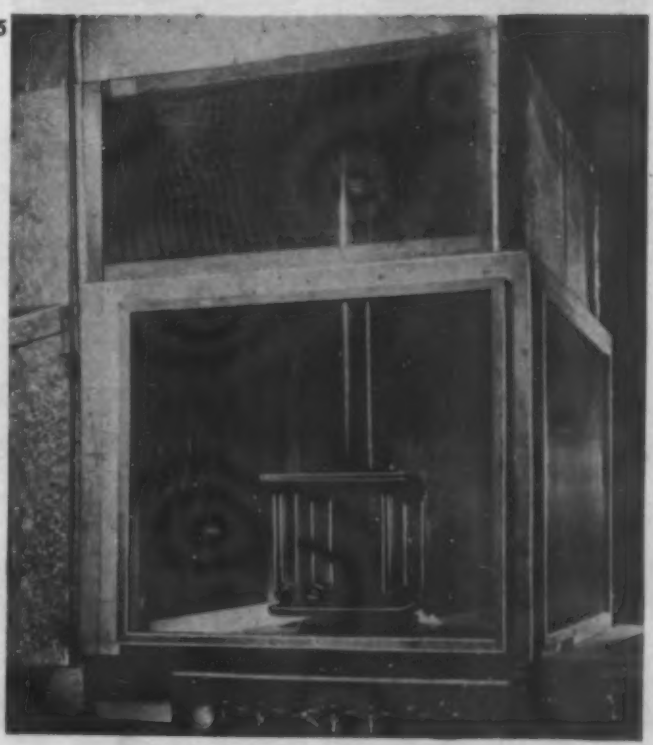

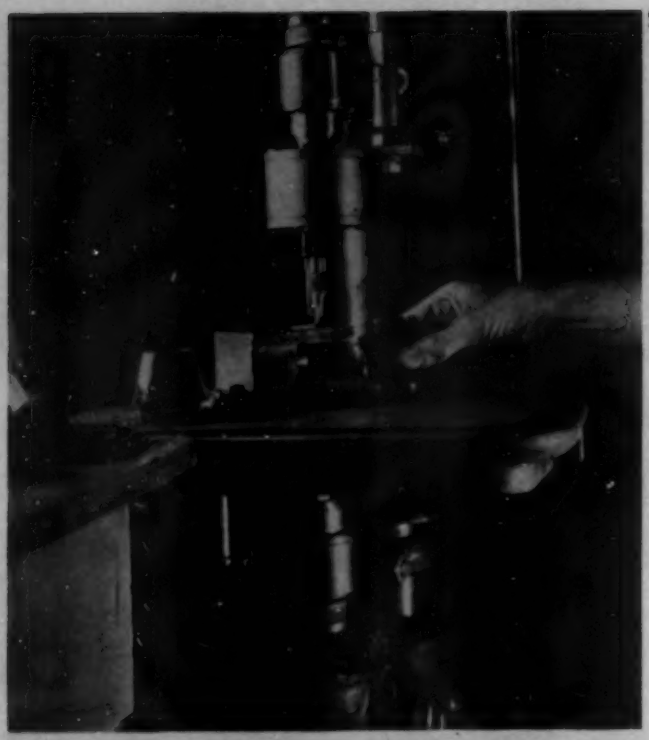

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PHOTOS 26 THROUGH 28, COURTESY JOSEPH STOKES RUBBER CO.

conveyor serves to return the empty pallets to the oscillator. On the day this plant was visited, the oscillator was being test operated with one press unit. At the same time two new 4-cavity units were being set up in presses. It is expected that by the time this article appears in print, the new system will be in complete operation since all phases of this new method have been checked on a production scale. Instead of 5+ min. for a total cycle, only 3 min. will be necessary. The speed of pot closing will be reduced from 1+ min. to a matter of 5 or 10 sec., this speed being accomplished with the same pressure on the material in the pot. Acetone extractables have checked approximately the same, but the company definitely expects far better quality through an increase in the density of the part.

In order to remove the human element as much as possible, the oscillator will be equipped with a completely automatic timing system. Figure 24 shows the preforms loaded in the pallets. One pallet is already in preheating position and the other is just being placed in position between the electrodes. Note the safety screen in the raised position. The small plunger which can be seen at the lower righthand side of the frame of the screen is part of a safety switch. When this plunger is withdrawn, it is impossible to connect the electrodes to the power source. Only after the screen is lowered as shown in Fig. 25, is it possible to turn on the power. The small control panel which is shown in boths Figs. 24 and 25 is all that is necessary to completely control this powerful unit. Not only has this company made use of the screen safety cage, but it employs a fluorescent bulb (Fig. 25, left) which lights up by induction whenever the power is on. After molding, the fuze parts are sent immediately to inspection where they are first checked for overall height. Due to the fact that this particular dimension has been one of the bigger problems of the job, this gaging operation is performed before any additional labor is expended upon the parts. The fuze bodies are then passed through to the finishing and final gaging operations. The Joseph Stokes Rubber Co. has set up its system for overall height gaging in such an efficient manner that 50 percent of all M-52 fuzes that it ships are height gaged by a blind girl operator using a feeler gage. This operator also performs a sanding operation for removal of flash which reduces the height to within the prescribed limits.

At this plant all finishing operations are performed by two operators. Figure 26 shows a multiple drilling setup at

28

***26**—A multiple spindle setup at Joseph Stokes Rubber Co. where 2 small holes are drilled and another reamed from the top, and the gate drilled from below.* ***27**—The second finishing operation makes use of 2 grinding wheels, a wire brush and a stream of compressed air.* ***28**—This view of the inspection setup shows the many operators needed for the work*

which two small holes are drilled and another reamed from the top. The sprue is drilled out from the bottom. Mounted on the shanks of these small tools are small wire brushes which completely remove fins left at the parting lines of the holes.

The second operation (Fig. 27) makes use of two grinding wheels, a wire brush and a stream of compressed air. The wheels permit the second operator to grind the flash from the top and bottom parting lines of the body, and the small wire wheel cleans out the fin from the large threaded sidehole. The operator then passes the body through the stream of compressed air so that any dirt remaining on the inside is blown out.

Except for the threads, practically all gaging operations are performed by hand with standard plug gages. In checking the threads, gages are mounted in chucks which have been adapted to small grinders such as those that are sold for normal home use in sharpening knives. The chucks are mounted on the units in place of the grinding wheels. With this setup, the operator moves the crank through approximately one-half turn. When transmitted through the system of gears, this movement rotates the thread-gages the number of turns necessary for gaging the threaded holes to their full depth. As in all the other plants, more man-hours are spent gaging and inspecting these parts than are used in all the finishing operations combined. As a matter of fact, this company reports the following labor breakdown in their production: 60 percent spent in molding, 30 percent used for inspection and gaging, and 10 percent employed in the finishing operations. The fact that only 10 percent of the total labor required to produce this part is spent in finishing operations should indicate to most readers one of the great advantages which accrue through the use of plastics. Through efficient mold design, highly intricate parts such as the M-52 fuze can be formed so near to their finished shape that very little additional labor is necessary to complete the part.

The next plant to be visited was Norton Laboratories, Inc., in Lockport, N. Y. Here again the M-52 fuzes are molded in an 8-cavity transfer mold but, as with the other plants, part of the mold design is unique to this one company. This difference in design relates to the transfer pot. Instead of using one pot per cavity or a pot for 8 cavities, Norton Laboratories, Inc., employs two pots—one for each row of 4 cavities. These pots (Fig. 29) are in the shape of slots, each slot having 4 sprue holes which permit the passage of the material from the pot into the cavities. The transfer plungers are undercut so that a positive withdrawal of the excess material and the sprues is obtained. The plungers also are equipped with knock-out pins which serve to eject the waste material.

When this 2-pot transfer setup was first put in operation, this molder like most of his competitors had some difficulty in working out the preheating of the preforms as well as holding their weight within the necessary limits. Variations in pot and mold temperature and in preform weight and flow

PHOTOS 29 THROUGH 31, COURTESY NORTON LABORATORIES, INC.

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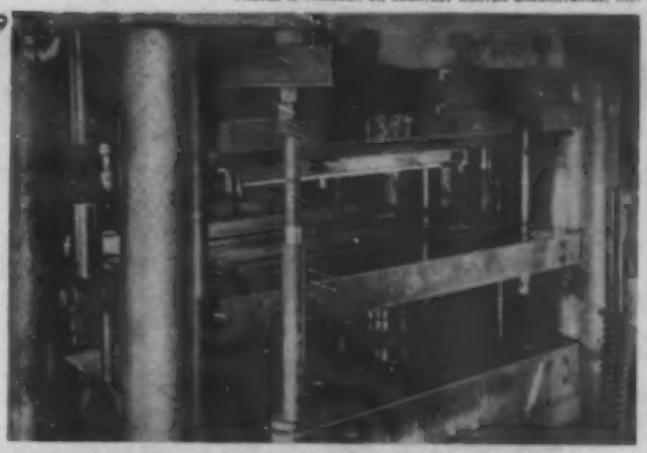

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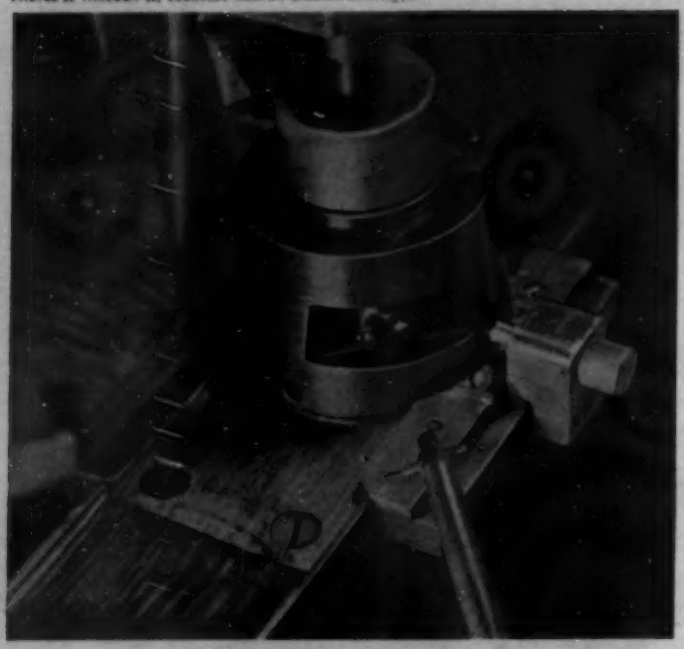
29—Two pots in the shape of slots—one for each row of 4 cavities—are employed at Norton Laboratories, Inc. Each pot has 4 sprue holes which permit the passage of material from the pot into the cavities. **30**—***The preforms are loaded into the transfer pots by means of a loading fixture.*** **31**—***After all the threaded pins and plugs are removed at this station they are transferred by a chute to the wedge assembly girls on the opposite side of the table. The cavities are then moved along a track to the girl at the No. 2 disassembly station***

PHOTOS 32 THROUGH 35, COURTESY NORTON LABORATORIES, INC.



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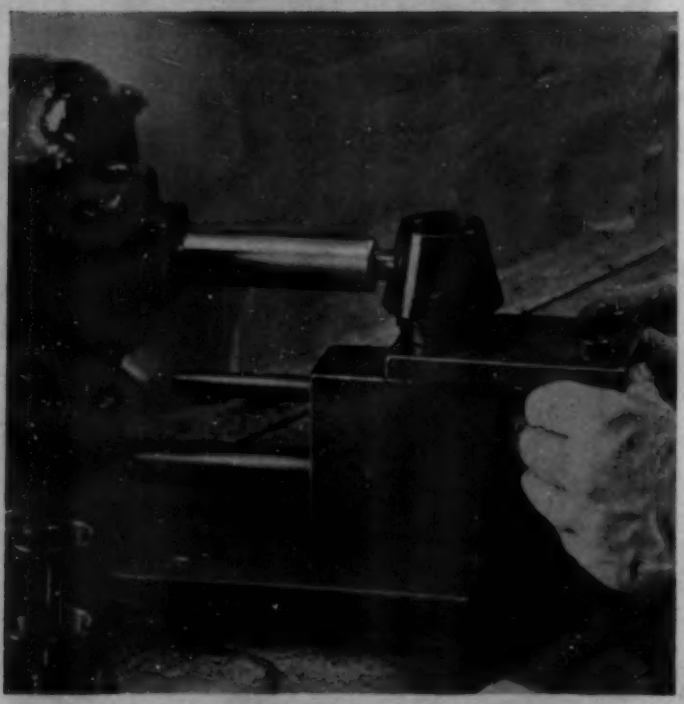

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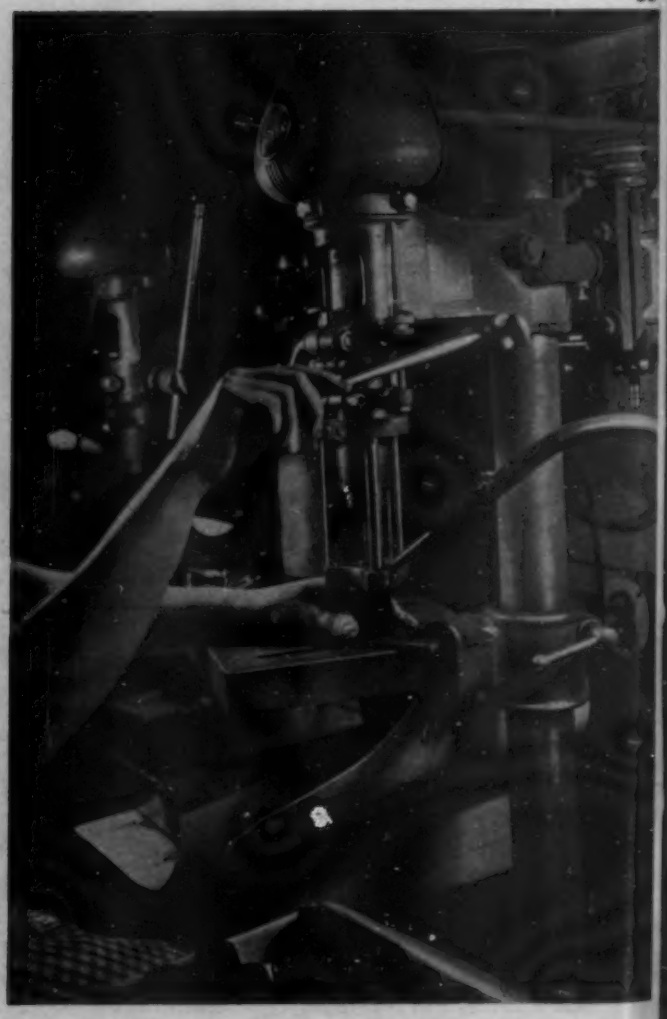

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caused uneven filling out of the cavities. This, in turn, resulted in non-uniformity in the over-all height of the parts. A book could be written on the problems which had to be surmounted by this molder before his production was satisfactory either to himself or to his prime contractor. Suffice it to say that his rejections are being held to a minimum.

The medium-impact phenolic material used in the production of these fuzes is automatically preformed or pilled at the rate of 2000 per hour. These preforms, before being loaded in the transfer pot, are preheated to 240° F. for approximately 10 minutes. As shown in Fig. 30, they are then loaded into the transfer pot by means of a loading fixture. The pot temperature is closely controlled at 290° F., and the chase is held at 340° F. After complete pot closing—that is, after material flow has completely ceased—the parts are given a $3^1/_2$-min. cure. This curing time, coupled with the open and pot closing time, adds up to a total over-all cycle of 5 min. 35 seconds. This cycle permits a total production of from 600 to 650 fuze bodies per 8-hr. shift per 8-cavity mold.

After the mold is opened and the cavities are ejected from the mold, they are transferred (*Please turn to page 162*)

32—*The top is being unscrewed from a cavity which is in position at station No. 2 of the unloading table.* **33**—*This rather unique setup for reaming flash from the slider-pin hole is employed at Norton Laboratories.* **34**—*A general over-all view of the gaging setup at this molding plant.* **35**—*Another of the finishing operations performed upon the trench mortar fuze bodies to prepare the parts for the final inspection prior to shipment*

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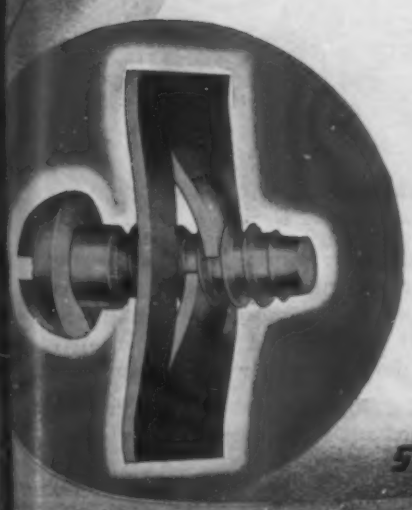

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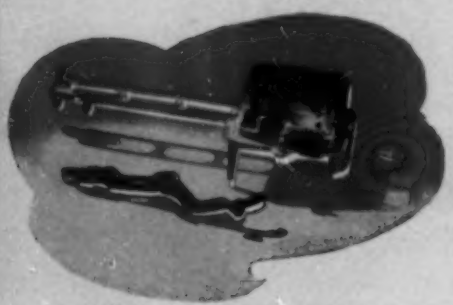
SPEED NUTS - THE FASTEST THING IN FASTENINGS!

HATS OFF
to the Plastic Molders

SOME DAY, somebody will write a big, thick book about what the hard-working, ingenious plastic molders have accomplished, particularly during the last three years of wartime. But until that book appears, let's tip our hats and throw a big bouquet to these resourceful men, who took one of industry's newest products and made it one of industry's most versatile working tools.



Radiosonde for weather reporting

When America entered the war, there was an immediate and widespread dislocation of manufacturing processes and products. Supplies and armament for warfare became the nation's Number One job. And right there is where the molders and resin plastics came through with new products, new applications, and new results that helped solve a great national emergency.

Let's look at a few of the problems that have been solved by inventive molders, working with the many adaptable features of Plaskon resin materials.

Here's the delicate but sturdy framework of a radiosonde. It is an instrument perfected by the Washington Institute of Technology, and makes possible the highly accurate weather forecasts so essential for military and aeronautical planning.

Basically, the radiosonde is a small radio sending set, attached to helium-inflated balloons. As they rise for miles through the air, the radiosonde begins a continuous broadcast, signaling the prevailing temperatures, barometric pressures, and humidity readings.

Principal attainments from the use of Plaskon Molded Color for this essential use are light weight for gaining higher altitudes; functional improvements; new accuracy standards in operation; and freedom from electrical disturbances. An intricate, accurately formed precision molding was absolutely essential for this job—and *the molder delivered the goods!*

Then there are the Plaskon melamine dishes, which have made such a radical change in American Navy tableware. A considerable number of widely varied requirements were met by the versatility of Plaskon melamine-formaldehyde.

The most important emergency need was the practical elimination of breakage due to gun shock, and ship "skidding" and rolling. Plaskon can withstand heavy shocks, sharp drops and concussions. Only under extreme destructive force will it crack or break, but it will not shatter or splinter. Not only is this an important economy factor, but also one assuring safety and freedom from cuts.

Very low moisture absorption, and complete resistance to staining by foods and liquids, were conditions met by Plaskon melamine-formaldehyde, to assure attractive tableware under long use.

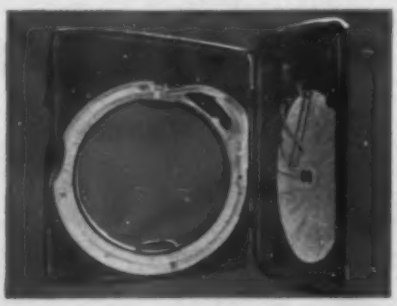
This new Plaskon melamine-formaldehyde tableware weighs about 70 per cent less than the crockery it replaces. When packed for shipment, it effects over 30 per cent saving of space. And due to the design possibilities of plastic material, the space needed aboard ship for storage of the new tableware is less than 50 per cent of that occupied by crockery.

Melamine tableware for Navy

The instrument in the next column is used by the Army and Navy for measuring stresses and strains in aircraft of all types. Faster, more powerful, more deadly combat craft are assured for our Armed Forces through the developments which are proved by this device.

The bezel, or white plastic ring around the inside of

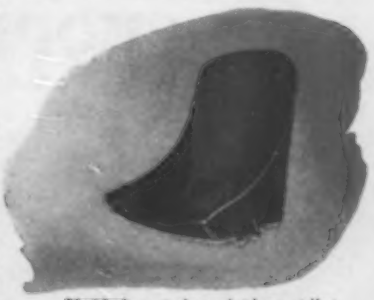
the door on this precision instrument, is molded of Plaskon. This Plaskon bezel gathers and reflects light from inside and outside illumination, making the



Bezel for precision recording instrument

chart and record more clearly visible and accurately read at all times. The ring also serves to keep the chart absolutely flat and level when the door is closed.

Pilot seats for airplanes are another notable example of how molders have met urgent wartime needs. Light weight, great strength, and added protection are some of the important features supplied by this pressure laminated product. It is made up of many laminations of canvas fabric, cut to shape. Each layer is thoroughly impregnated with Plaskon Resin Glue. The assembled sheets then are placed in a pattern mold, and hydraulic pressure is applied with a forming mold.



Molded seat for airplane pilot

The finished, accurately formed seat is tremendously strong; immune to shocks, strains, moisture conditions; and will never warp, split or delaminate. This is but one of many low-pressure laminating jobs using Plaskon Resin Glue, that have helped meet the nation's big-volume airplane production schedule.

Hats off to the plastic molders of America—they're doing a great job. Their experience in solving wartime problems is preparing them for a new and wider measure of service in the markets of tomorrow.

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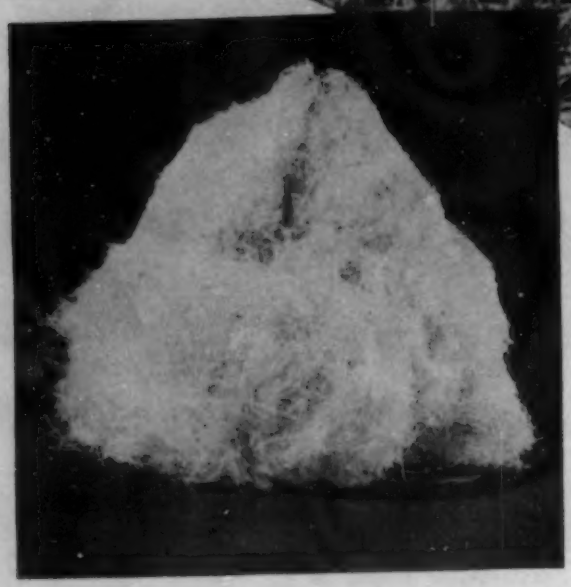

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Fatigue of urea assembly adhesives†

by ALBERT G. H. DIETZ* and HENRY GRINSFELDER**

ASSEMBLY adhesives, made of cold-setting urea-formaldehyde synthetic resins, are employed in the fabrication of wooden aircraft such as gliders and motor-driven airplanes. Adhesives so used are frequently subjected to vibrating loads which induce alternating stresses in the glue. Of these stresses, shear in the plane of the glue and direct tension perpendicular to the glue line are the two which are most likely to bring about failure. It is well known that most materials fail under alternating stresses smaller in magnitude than the static stresses required to cause failure—and synthetic resin assembly adhesives are no exception. However, little has been known quantitatively respecting the behavior of such adhesives under alternating stresses.

In this paper are presented the results of research into the failures to be expected in glue joints of this kind, particularly the nature of the failure, cycles of stress to failure at various amplitudes and stresses, and the probable fatigue limit of such an assembly. Tests were carried out at room temperatures on an assembly adhesive representative of those employed in aircraft fabrication.

Materials and test specimens

Panels of overlapping 1/8-in. rotary-cut maple veneers were made up, as shown in Figs. 1 and 2. The two outer members *a* overlapped and were glued to the two inner members *b* over a distance of approximately 1 1/2 inches. The line *b-b* was glued throughout its length, so that the center member behaved as a single piece 1/4 in. thick. Maple was chosen because it is standard shear-block material, is relatively difficult to bond and is moderately strong.

The panels were prepared with glue made up as follows: urea resin powder—70 parts, and water—30 parts. Spreading was by hand brushing on both the surfaces which were being bonded. The assembly time ranged from 5 to 25 minutes. In all cases, the assemblies were closed immediately after spreading and kept closed until the pressure was applied. Bonding was for 16 hr. at a temperature of 75° F., and the bonding pressure was 200 p.s.i., applied by means of a Black "Compressometer."

Two sets of panels were made because difficulties encountered in obtaining satisfactory results with the first set necessitated the fabrication of more material. Panels were numbered as follows:

First set	*Second set*
A2	AA1
A3	AA2
A4	AA3
A5	AA4
A6	AA5
A7	AA6

Specimens 1 in. wide were cut from the panels as shown in Figs. 1 and 2. The overlap was cut to 1 in., as shown in Fig. 1, to provide 2 sq. in. of glue line. A few specimens were cut to 3/4 in. for experimental purposes. At the ends of glue lines *a-b*, beads of glue had squeezed out into the internal corners. In some instances the bead was removed, and in some it was notched with a saw. However, it was found by test that the glue actually cracked after a few alterations of stress so that

† Presented before a joint meeting of the Rubber and Plastics and Aviation Divisions of the American Society of Mechanical Engineers, New York, N. Y., on Dec. 1, 1943.

* Assistant professor of Structural Engineering and Materials, Department of Building Engineering and Construction, Massachusetts Institute of Technology.

** Senior engineer, Resinous Products and Chemical Co.

1—Specimens 1 in. wide were cut from panels of overlapping 1/8-in. rotary-cut maple veneers. The overlap was cut to 1 in. to provide 2 sq. in. of glue line. 2—This drawing shows manner in which specimens were marked

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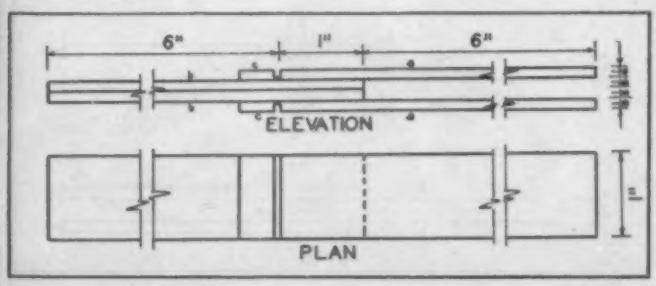

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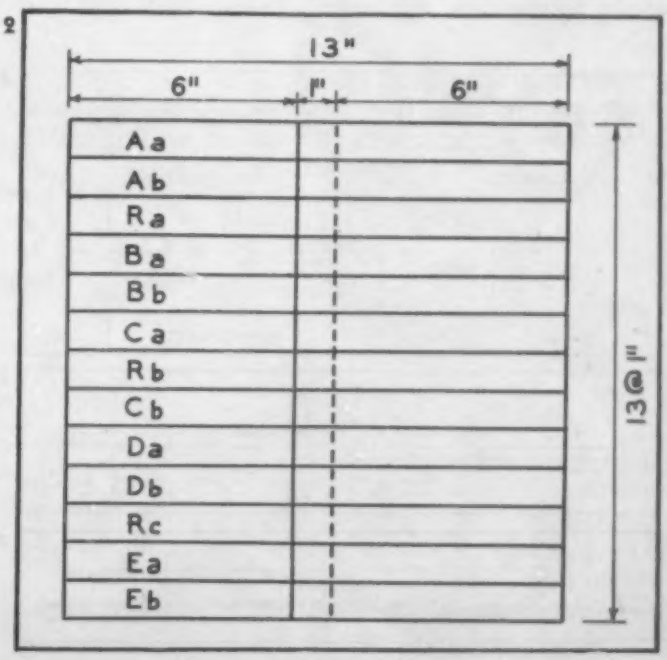


it was unnecessary to pay any particular attention to the fillet caused by glue bead.

Specimens were marked as shown in Fig. 2. Those marked Ra, Rb and Rc were intended for "modulus of rupture" tests—that is, to determine the breaking strength of the assemblages. Specimens Aa, Ba, etc., were intended for vibration tests; specimens Ab, Bb, etc., for static shear tests. For the first set of panels it was not possible to adhere to this schedule rigidly because of experimental difficulties to be described later but, in general, the specimens were so employed in the second set of panels. Moisture content of the material was approximately 9 percent during the tests.

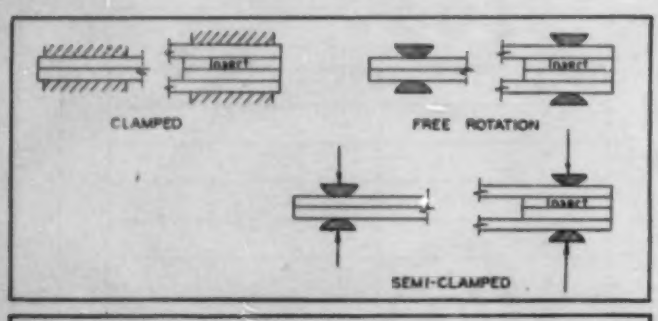
Test methods

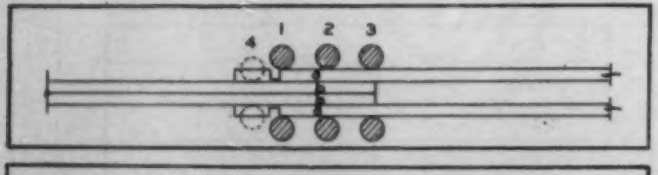
Vibration—Because of the number of specimens involved and the length of time required for some of the tests, it was necessary to employ a machine which could handle several specimens at one time. The machine is shown in Fig. 3. In this apparatus the specimens, in groups of two, are held between upright pairs of cold-rolled steel plates which, in turn, are bolted to a heavy horizontal steel bar fastened to the steel base-plate supporting the entire apparatus. The centers of the specimens are forced back and forth by a pusher attached to a driving rod pinned to a connecting rod which, in turn, is mounted on an eccentric which forms part of a heavy steel driving wheel. The eccentric can be adjusted to give a throw ranging from 0 to $1^1/_2$ inches. The driving wheel is mounted in a heavy bronze bearing and is belt-driven by a 1-hp. motor. The machine can be operated at various speeds but, in these tests, was limited to 1100 to 1300 revolutions per minute.

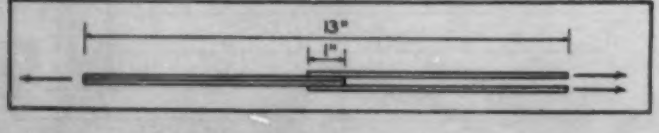
Three different methods of supporting the ends of specimens as shown in Fig. 4 were tried. The first method—rigid clamping—resulted in fairly frequent fatigue failures in the wood at the supports. Free rotation of the ends—the second method of support—required large deflections at the centers to yield appreciable stresses and caused numerous wood fatigue failures at the center. The end support which was finally adopted—the one which yielded generally satisfactory results—consisted of rounded supports between which the specimens were firmly held by bolts exerting pressure as shown. This allowed a little rotation at the ends, resulting in a semi-clamped condition.

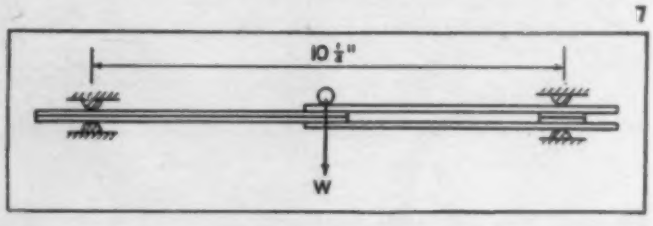
Four different positions of the pusher were tried, as shown in Fig. 5. Position 2 was first employed, but it resulted in fatigue failures in the wood rather than glue-line failures because even the slight compression applied by the pusher to the glue line prevented tensile stresses from building up to the point where failure could occur. Such a condition would not generally be found in actual practice. Position 3 was somewhat better, but Position 4 resulted in rather quick wood failures. Position 1, which was finally adopted for the pusher, proved best from all standpoints. It allowed tensile stresses to develop freely. Fairly high percentages of glue-line failures resulted when the pusher was employed in this position.

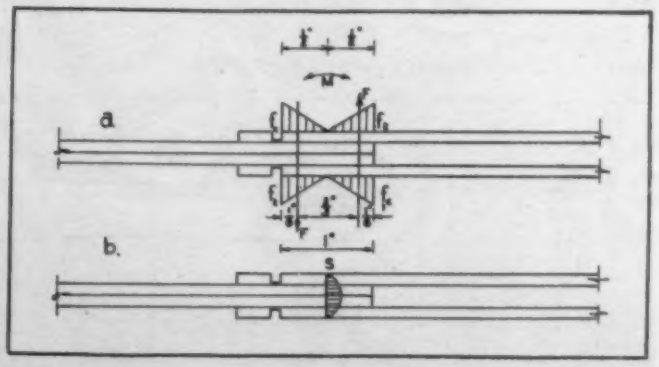
***3**—Vibration machine with two alternating stress specimens in place. End supports are semi-clamped. **4**—Three different methods of supporting the ends of specimens. **5**—This drawing illustrates 4 different positions of the pusher which were tried. **6**—Static shear control specimens were placed in tension grips of a 10,000-lb. beam-type universal testing machine and pulled apart, as shown. **7**—In tests to determine breaking strengths and deflections, specimens were supported at the ends and loaded with dead weights at the center. **8**—This sketch shows approximate relationship between external center bending moment M and internal resisting moment*











and the saw-cuts were held approximately $^1/_{32}$ in. short of glue line *a-b* to avoid local concentrations of stresses which would cause the wood to fail in fatigue. The pusher was not pressed firmly against the wood but was allowed to clear by a few thousandths of an inch or, at most, to come into light contact. Tests were carried to failure or to 5,000,000 cycles. Two, 4 or 6 specimens were tested at one time, depending upon the amplitude.

Static shear—Static shear control specimens were placed in the tension grips of a 10,000-lb. beam-type universal testing machine and pulled apart, as shown diagrammatically in Fig. 6. Under this load, shear stresses are set up in the glue lines *a-b*, accompanied by some tension perpendicular to the glue line occasioned by the eccentricities in the joints. The stresses are mainly shear, however.

Static bending—Selected specimens, generally those marked Ra, Rb, Rc, were loaded statically to rupture to determine the breaking strengths and deflections so that the amplitudes to employ in the vibration tests could be decided. As shown diagrammatically in Fig. 7, specimens were supported at the ends in the same manner as the vibrated specimens, and they were loaded with dead weights at the center in the same manner as the vibrated specimens except that loads were carried to failure. Loads and deflections to failure were recorded.

Calibration—Each vibration specimen was calibrated by loading in the same manner as the modulus of rupture specimens except that loads were carried only to deflections corresponding to the amplitudes through which the specimens were to be vibrated. In order to determine the end restraining moments at the supports, induced by clamping and semi-clamping, a number of specimens were tested twice—once as freely supported simple beams with no end restraint and again as clamped or semi-clamped specimens.

d_f = deflection at the center of a freely supported beam loaded at the center,
d_c = deflection at the center of a beam completely restrained at its ends and loaded at the center,
W = concentrated load at the center,
L = length of the beam,
E = modulus of elasticity,
I = moment of inertia,
M_f = bending moment at the center of a freely supported beam loaded at the center,
M_c = bending moment at the center of a beam completely restrained at its ends and loaded at the center,
M_r = restraining moment at the ends of a completely restrained beam.

$$d_f = \frac{1}{48} \cdot \frac{WL^3}{EI} \tag{1}$$

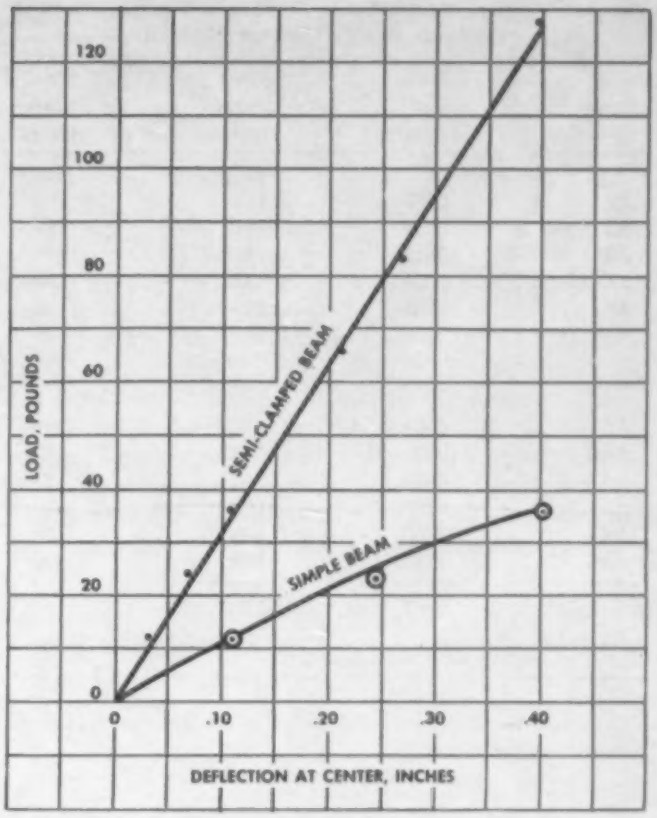
$$d_c = \frac{1}{192} \cdot \frac{WL}{EI} = \frac{1}{4} d_f \tag{2}$$

$$M_f = \frac{WL}{4} \tag{3}$$

$$M_c = \frac{WL}{8} \tag{4}$$

$$M_r = -\frac{WL}{8} \tag{5}$$

For semi-clamped specimens the deflections are intermediate between (1) and (2), and the corresponding center moments are intermediate between (3) and (4). By determining the deflections for (1) and for the semi-clamped condition, the center moments for the semi-clamped condition can also be determined, and from these, the maximum tensile stresses perpendicular to the glue line at the overlap. Shear stresses can be determined from the load whose magnitude is known as a function of the amplitude (or deflection).



9—*This diagram shows a typical set of load-deflection curves of simple beams and semi-clamped beams*

Figure 8 shows the approximate relationship between the external center bending moment M and the internal resisting moment. With the pusher in Position 1 (Fig. 5), tensile and compressive stresses are set up across the glue lines and are approximately triangular in distribution. The varying stresses f have resultants F, acting at the centers of gravity of the triangular stress volumes. The equal and opposite resultants F form a couple $F \times {}^2/_3$ in. which resists the external moment M. The resultant F is equal to

$$F = \frac{2f}{2} \times {}^1/_2 \times 1 \text{ in., and } F \times {}^2/_3 \text{ in.} = \frac{f}{3} \tag{6}$$

or

$$M = \frac{f}{3} \text{ and } f = 3M \tag{7}$$

The actual stress distribution is somewhat different from the simplified picture here represented, inasmuch as M varies slightly from one end of the overlap to the other because of shear. This tends to increase f in some portions of the overlap and to decrease it in others. For practical purposes, the stress distribution is closely enough that shown.

(*Please turn to next page*)

TABLE I.—STATIC SHEAR TESTS OF MAPLE VENEERS BONDED WITH UREA RESIN "UFORMITE CB-551"

Panel No.	Shear load, average	Shear stress, average	Wood failure, average
	lb.	p.s.i.	percent
A2	2857	1428	75
A3	2626	1313	83
A4	2842	1422	70
A5	2664	1332	99
A6	2788	1394	90
A7	2960	1480	95
Averages[a]	2916	1458	80
AA1	2864	1432	90
AA2	2851	1425	95
AA3	2929	1465	85
AA4	2700	1350	70
AA5	2706	1353	90
AA6	2792	1396	100
Averages[a]	2807	1403	90

[a] Averages of all individual tests. Panel averages weighted in accordance with number of tests from each panel.

TABLE II.—STATIC BENDING TESTS OF MAPLE VENEERS BONDED WITH UREA RESIN "UFORMITE CB-551"

Panel No.	Bending load	Shear stress	Tension across glue line	Wood failure
	lb.	p.s.i.	p.s.i.	percent
A2	203	230	865	50
A3	132	150	695	75
A5	152	170	800	100
A6	148	165	775	90
Averages[a]	174	195	815	70
AA1	203	230	1015	50
AA2	187	210	935	90
AA3	170	190	850	95
AA4	167	190	835	45
AA5	172	195	860	70
AA6	106	120	530	45
Averages[a]	165	185	815	65
Total Average	169	190	815	65

[a] Average of all specimens, not of averages.

Average shear stress in the plane of the glue lines is given by the familiar expression

$$s = \frac{VQ}{bI} \qquad (8)$$

and is as shown in Figure 8b. This is the average condition. It is probable that the true shear stress deviates from this at the ends of the overlap.

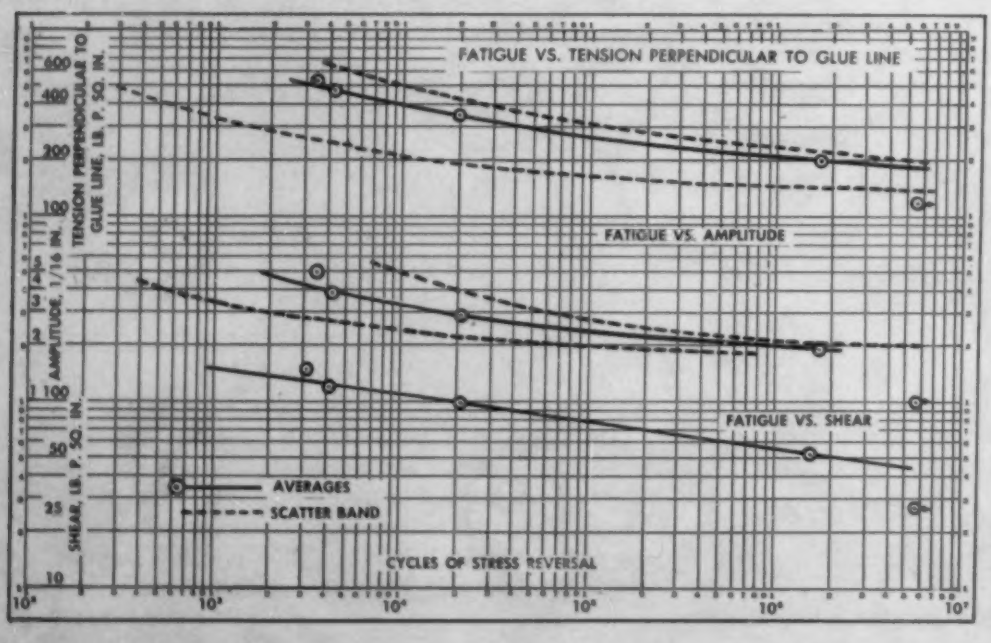
Test results

Test results are summarized in Tables I to III and Figs. 9 and 10. Considerable scatter in the results is found although trends are clearly visible. Marked difficulty was encountered in obtaining satisfactory failures at the glue lines; failure was as apt to occur in the wood as in the glue line. This was particularly true of the vibration specimens.

Static shear—Table I gives the average results of static shear tests for the various panels. In the first set, average strength is 1458 p.s.i. accompanied by 80 percent average wood failure. In the second set the corresponding figures are 1403 and 90, respectively. The shear strength averages are less than are found in the standard shear block but are considerably higher than in the standard plywood shear specimens. The shape of the specimen and its general proportions, inducing variable amounts of tension because of eccentric loading, as well as non-uniform shear distribution in the joint, must account for the different values attained.

Static bending (modulus of rupture)—Figure 9 is a typical set of load-deflection curves for a modulus of rupture specimen. The lower curve is for the specimen simply supported, the upper for the semi-clamped end. In general, deflections for semi-clamped condition were approximately one-third those for the simple beam, indicating a center moment of approximately $WL/7$. Center moments for the clamped and semi-clamped tests ranged from better than $WL/6$ to $WL/8$.

Average values of modulus of rupture for the various panels tested, averages for the two sets of panels and overall averages are given in Table II. Shear stresses were calculated by equation (8) and maximum tension (*Please turn to page 160*)


FATIGUE VS. TENSION PERPENDICULAR TO GLUE LINE
FATIGUE VS. AMPLITUDE
FATIGUE VS. SHEAR
TENSION PERPENDICULAR TO GLUE LINE, LB. P. SQ. IN.
AMPLITUDE, 1/16 IN.
SHEAR, LB. P. SQ. IN.
AVERAGES
SCATTER BAND
CYCLES OF STRESS REVERSAL

10—*These curves show the results of tests in which glue-line failures occurred under alternating stresses. Results are for clamped or semi-clamped specimens and for specimens in which failure was complete, except for those which ran to 5 million cycles without failure*

Impact strength of reinforced plastics*

by PHILIP M. FIELD

THESE tests were conducted to determine the impact strength of reinforced thermosetting plastics, to determine the effect of elevated and reduced temperature on their impact strength and to compare the impact strength of plastic materials with that of aluminum and cast magnesium.

The materials tested were submitted by various manufacturers. They include phenol-formaldehyde and special resins reinforced with cotton, paper, asbestos, wood or glass in various forms. The majority of the materials are commercially available as standard N.E.M.A. grades. The detailed construction of each material is indicated in Table I. One material was supplied in the form of molded bars, the others as laminated sheets from which specimens were machined. The majority of materials were molded at high pressures (over 2000 p.s.i.) used in the manufacture of commercial grades. For these materials the molding pressure is marked "high"; for low-pressure laminates, the molding pressure is given.

Tests were conducted on 2.5 × 0.5 × 0.5 in. notched Izod specimens.[1] On specimens exactly 0.500 thick, the depth of notch was 0.100. However, where the thickness varied from 0.500, care was taken to maintain the thickness back of the notch at 0.400 ± 0.002 inch. The only available impact testing machine was one having ranges of 110 and 220 ft.-lb. capacity. The lower range was used in all tests, permitting determinations of absorbed energy to the nearest 0.5 foot-pound. Impact strength at high temperature (+160° F.) and low temperature (−70° F.) was determined by testing specimens at room temperature immediately upon removal from the conditioning chamber. The facewise and edgewise impact strength of each material was determined at each condition on duplicate specimens.

Test results

The test results obtained are presented in Table I. The strongest plastic material was F20, a glass- and cotton-reinforced phenolic which has an impact strength at room temperature of 22.5 and 18.0 ft.-lb. per in. for face and edge-

* Based on Report No. AMS(M)-657, Aeronautical Materials Laboratories, Engineering Div., Naval Aircraft Factory.

[1] Naval Aircraft Factory Manual, "Test Procedure for Plastic and Plywood Material Intended for Structural and Semi-Structural Aircraft Uses" (Sept. 1942).

1—*These diagrams illustrate the variation of impact strength with temperature*

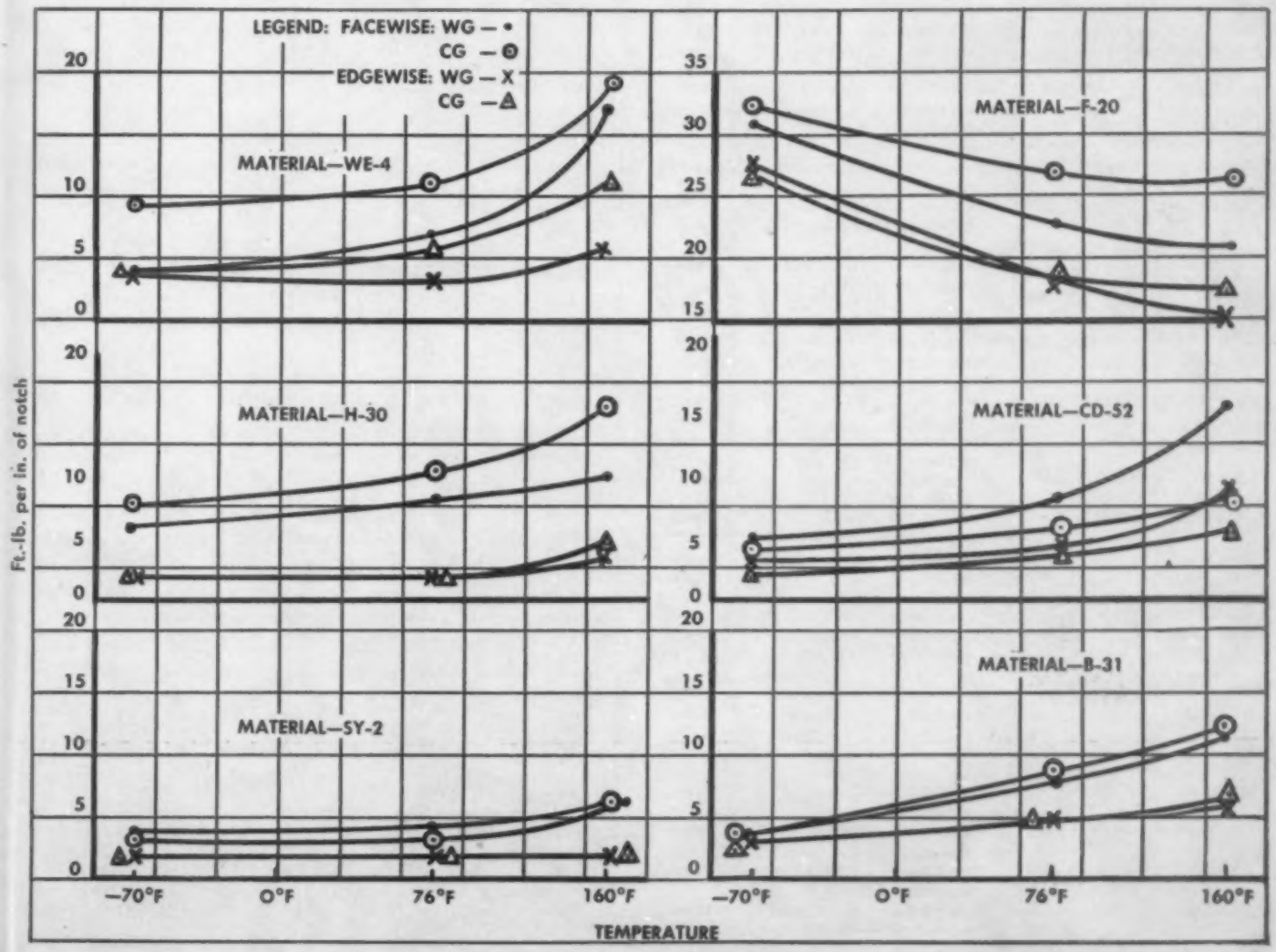


Table I.—Impact Strength of Reinforced Thermosetting Plastics

Sample designation[a]	Grade	Description of material: Resin	Reinforcing agent	Form	Molding pressure, p.s.i.	Specific gravity	Izod impact strength ft.-lb/in., of notch[b]: Room temperature, Location of notch: Face	Room temperature, Location of notch: Edge	High temperature (+160° F.), Location of notch: Face	High temperature (+160° F.), Location of notch: Edge	Low temperature (−70° F.), Location of notch: Face	Low temperature (−70° F.), Location of notch: Edge
Al Alloy	24 ST	.....	.....	Rolled	...	2.72	20	25	....	...	...	...
Al Alloy	46 A-le Class 4	.....	.....	Cast	...	2.60	4.3	...	...	...	...	...
Magnesium	O1	.....	.....	Extruded	...	1.74	21	...	...	...	...	...
Magnesium	M	.....	.....	Cast	...	1.74	9.5	...	...	...	7.0	...
B-29	.....	Phenol-formaldehyde	Cord	Macerated	High	1.40	11	11	17	13	12.5	14
B-31 WG	.....	Phenol-formaldehyde	Cotton	Fabric	100	1.35	8.0	5.0	11.5	6.0	4.0	3.0
B-31 CG	.....	Phenol-formaldehyde	Cotton	Fabric	100	....	8.5	5.0	12.5	6.5	4.0	3.0
BB-6 WG	.....	Phenol-formaldehyde	Paper	Sheet	High	1.49	2.0	1.0	2.0	.5	1.0	< .5
BB6-CG	.....	Phenol-formaldehyde	Paper	Sheet	High	....	2.5	1.0	3.0	1.0	1.0	<0.5
CD-35 WG	.....	Phenol-formaldehyde	Canvas	Macerated	200	1.31	3.0	3.0	4.0	4.0	3.0	2.0
CD-35 CG	.....	Phenol-formaldehyde	Canvas	Macerated	200	....	3.0	3.0	4.0	4.0	2.5	2.0
CD-47 WG	Special	Special resin	Cotton	Fabric	300	1.34	3.5	2.0	5.5	3.5	2.0	2.0
CD-47 CG	Special	Special resin	Cotton	Fabric	300	....	3.0	2.0	5.0	3.0	2.0	2.0
CD-52 WG	NEMA "XXXP"	Phenol-formaldehyde	Paper	Sheet	High	1.39	8.0	4.0	13.0	8.5	5.0	3.0
CD-52 CG	NEMA "XXXP"	Phenol-formaldehyde	Paper	Sheet	High	....	5.5	3.5	8.0	5.0	4.0	2.0
DA-10 WG	.....	Melamine	Paper	Sheet	High	1.49	1.0	<0.5	<0.5	<0.5	0.5	<0.5
DA-10 CG	.....	Melamine	Paper	Sheet	High	....	1.0	<0.5	<0.5	<0.5	1.0	<0.5
F-15 WG	NEMA "A"	Phenol-formaldehyde	Asbestos	Paper	High	1.80	2.0	2.0	2.0	1.5	2.0	1.0
F-15 CG	NEMA "A"	Phenol-formaldehyde	Asbestos	Paper	High	....	1.0	1.0	1.0	1.0	1.0	1.0
F-17WG	NEMA "AA"	Phenol-formaldehyde	Asbestos	Fabric	High	1.58	4.5	5.0	6.0	5.5	6.0	4.5
F-17 CG	NEMA "AA"	Phenol-formaldehyde	Asbestos	Fabric	High	....	5.0	4.0	5.0	4.0	5.0	4.0
F-19 WG	NEMA "X"	Phenol-formaldehyde	Paper	Sheet	High	1.36	2.5	1.0	3.0	<0.5	3.0	1.0
F-19 CG	NEMA "X"	Phenol-formaldehyde	Paper	Sheet	High	....	2.0	1.0	2.0	<0.5	2.0	1.0
F-20 WG	.....	Phenol-formaldehyde	Glass and cotton	Alternate layers of fabric	High	1.64	22.5	18.0	20.5	15.0	30.5	27.5
F-20 CG	.....	Phenol-formaldehyde	Glass and cotton	Alternate layers of fabric	High	1.64	26.5	18.5	26.0	17.5	32.0	26.5
FP-18 WG	.....	Phenol-formaldehyde	Spruce sulfite paper	Sheet	High	1.39	4.0	1.0	4.0	1.0	4.0	1.0
FP-18 CG	.....	Phenol-formaldehyde	Spruce sulfite paper	Sheet	High	1.39	4.5	1.0	4.0	1.0	4.0	1.0
CE-2 WG	NEMA "C"	Phenol-formaldehyde	Cotton	Fabric	High	1. 4	3.5	2.0	4.5	2.5	2.0	1.5
CE-2 CG	NEMA "C"	Phenol-formaldehyde	Cotton	Fabric	High	....	3.5	2.0	5.0	2.0	2.0	2.0
GE-4 WG	NEMA "XP"	Phenol-formaldehyde	Paper	Sheet	High	1.35	2.0	<0.5	2.0	<0.5	2.0	1.5
GE-4 CG	NEMA "XP"	Phenol-formaldehyde	Paper	Sheet	High	....	1.0	<0.5	2.0	1.0	2.0	2.0
H-30 WG	.....	Phenol-formaldehyde	Cotton	Combed fibers	High	1.18	8.0	2.0	10.0	3.0	6.0	3.0
H-30 CG	.....	Phenol-formaldehyde	Cotton	Combed fibers	High	....	10.0	2.0	15.5	4.5	7.5	2.0
H-34 WG	.....	Phenol-formaldehyde	Philippine mahogany + impregnated fibers	Sheet	500	0.62	3.0	1.0	2.0	1.0	2.0	<0.5
H-34 CG	.....	Phenol-formaldehyde	Philippine mahogany + impregnated fibers	Sheet	500	....	2.0	1.0	1.0	<0.5	1.0	<0.5
MR-2 WG	NEMA "LE"	Phenol-formaldehyde	Cotton	Fabric	High	1.33	3.0	2.0	6.0	3.0	2.5	2.0
MR-2 CG	NEMA "LE"	Phenol-formaldehyde	Cotton	Fabric	High	....	5.0	2.5	9.0	5.0	3.5	2.0
PA-4 WG	.....	Phenol-formaldehyde	Kraft paper	Sheet	High	1.36	3.0	<0.5	4.0	0.5	3.0	<0.5
PA-4 CG	.....	Phenol-formaldehyde	Kraft paper	Sheet	High	....	2.0	<0.5	4.0	1.0	2.0	<0.5

TABLE I.—IMPACT STRENGTH OF REINFORCED THERMOSETTING PLASTICS (*Continued*)

Sample designation[a]	Description of material: Grade	Resin	Reinforcing agent	Form	Molding pressure, p.s.i.	Specific gravity	Izod impact strength ft.-lb./in. of notch[b]: Room temperature, Location of notch: Face	Edge	High temperature (+160° F.), Location of notch: Face	Edge	Low temperature (−70° F.), Location of notch: Face	Edge
RI-50 WG	.....	Phenol-formaldehyde	Asbestos	Felted fibers	High	1.61	4.0	2.0	5.0	3.0	4.0	2.0
RI-50 CG	.....	Phenol-formaldehyde	Asbestos	Felted fibers	High	....	5.0	2.0	5.5	3.0	5.0	3.0
SP-3 WG	NEMA "CE"	Phenol-formaldehyde	Cotton	Fabric	High	1.35	4.0	2.0	7.5	4.0	4.0	2.0
SP-3 CG	NEMA "CE"	Phenol-formaldehyde	Cotton	Fabric	High	....	5.5	3.0	6.5	5.5	5.0	3.0
SY-2 WG	NEMA "L"	Phenol-formaldehyde	Cotton	Fabric	High	1.34	4.5	2.0	6.0	2.0	4.0	3.0
SY-2 CG	NEMA "L"	Phenol-formaldehyde	Cotton	Fabric	High	....	3.5	2.0	6.0	2.0	3.0	2.0
SY-4 WG	NEMA "XX"	Phenol-formaldehyde	Paper	Sheet	High	1.37	2.0	1.0	2.0	0.5	1.5	1.0
SY-4 CG	NEMA "XX"	Phenol-formaldehyde	Paper	Sheet	High	....	2.0	1.0	1.0	<0.5	1.0	1.0
WE-2 WG	NEMA "XXX"	Phenol-formaldehyde	Paper	Sheet	High	1.32	1.0	<0.5	1.5	1.0	3.0	2.0
WE-2 CG	NEMA "XXX"	Phenol-formaldehyde	Paper	Sheet	High	1.32	2.0	1.0	2.0	<0.5	3.5	2.0

[a] Abbreviations: WG = with grain; CG = cross grain.
[b] Figures are averages of 2 test values.

wise impact, respectively. This exceeds the value for cast magnesium (9.5) and cast aluminum alloy (4.3), and is of the same order of magnitude as extruded magnesium (21.0) and rolled 24ST aluminum alloy (20). The two next best materials, in order, were B29, a molded cord-reinforced phenolic having an impact strength of 11 ft.-lb. per in., and B31, a low-pressure fabric-base phenolic having a strength of 8.2 (face) and 5.0 (edge) ft.-lb. per inch. FP18, a phenol-formaldehyde resin reinforced with Mitscherlich (spruce sulfite) paper, exhibited very poor edgewise impact strength, viz., 1.0 ft.-lb. per inch. The variation in impact strength with temperature for the stronger materials is shown graphically in Fig. 1.

Discussion of results

Impact strength is important as a measure of the ability of a material to withstand shock loads and as a rough indication of how well a material will stand up under handling and general wear and tear. High impact strength, being defined in terms of energy absorption, is related to the ability of a material to deform under load, and hence it is related to the general property of toughness. Although impact-strength values cannot be used by the designer to predict performance of a new design in the same analytical way as tensile- or compressive-strength values can be used, it has been shown that a good correlation exists between the impact strength of molded plastic materials and the service of objects made from them.[2]

Determination of impact strength by the conventional single-blow technique does not result in complete information on the ability of a material to perform under service conditions involving shock. It is also important to know how well a material will withstand repeated impact loads and to determine its impact "fatigue limit," defined as the amount of energy with which a material can be struck indefinitely without measurable damage. A summary of the results of a preliminary investigation on this subject in another laboratory[3] is given in Table II. These tests were conducted on notched and unnotched specimens under the impact of a falling ball. It was found that for some thermoplastic materials, the impact fatigue strength was as low as 3.6 percent of the single-blow impact strength. For reinforced phenolic materials the value was approximately 50 percent.

For a majority of the materials, the strength was greater at elevated temperature and lower at reduced temperatures. However, this trend was reversed in the case of the glass-reinforced material. Additional information on the variation of impact strength with temperature is contained in the literature.[4, 5] For cotton-cord and fabric-filled materials, the impact strength was reported to increase with a rise in temperature up to a maximum (*Please turn to page 162*)

[2] "Impact Testing of Plastics," by Robert Burns and W. W. Werring, MODERN PLASTICS *15*, 37–41, 52, 54, 56 (Aug. 1938).
[3] Unpublished Laboratory Report on Impact Fatigue Strength of Plastic Materials, by R. Burns, Bell Telephone Laboratories, New York, N. Y.
[4] "Temperature vs. Strength for Phenolics," by T. S. Carswell, D. Telfair and R. U. Haslanger, MODERN PLASTICS *19*, 65–69 (July 1942).
[5] "High Impact Molding Compounds," by C. H. Whitlock and R. U. Haslanger, MODERN PLASTICS *19*, 70–71 (June 1942).

TABLE II.—RELATIONSHIP BETWEEN SINGLE BLOW AND REPEATED BLOW IMPACT STRENGTH[c]

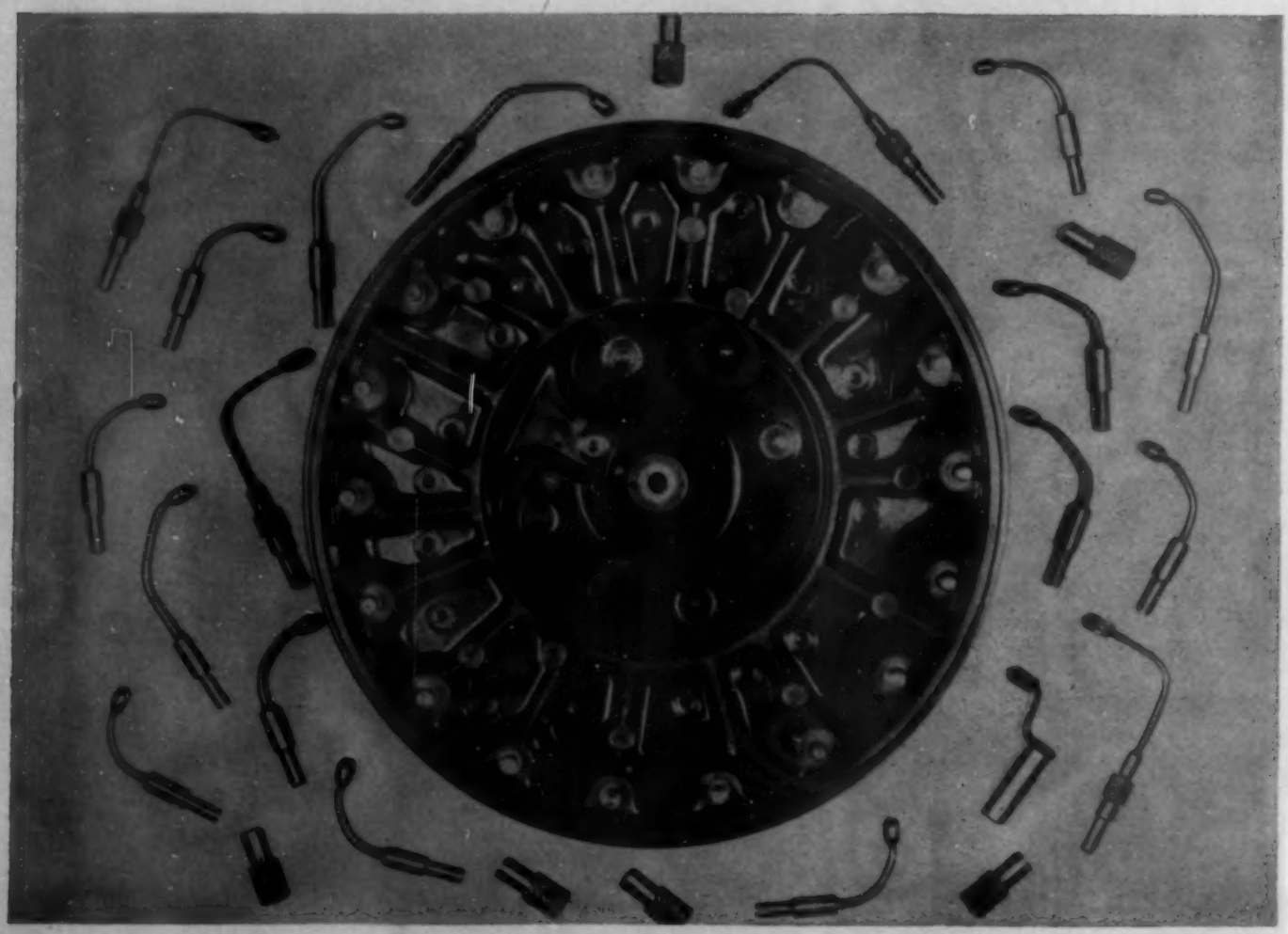
Material	Relation of repeated blow impact strength to single blow impact strength
	percent
Acrylate resin, compression-molded	50
Acrylate resin, injection-molded	60
Acrylate resin, cast	41
Polystyrene, compression-molded	40
Phenolic compound, compression-molded	27
Hard rubber	22
Cellulose acetate butyrate, injection-molded	
Hardness S2	3.6
MS	5.7
H Blend A	4.5
H Blend B	10
Nylon, injection-molded	58
Phenolic laminate, paper-base	50
Phenolic laminate, fabric-base	45

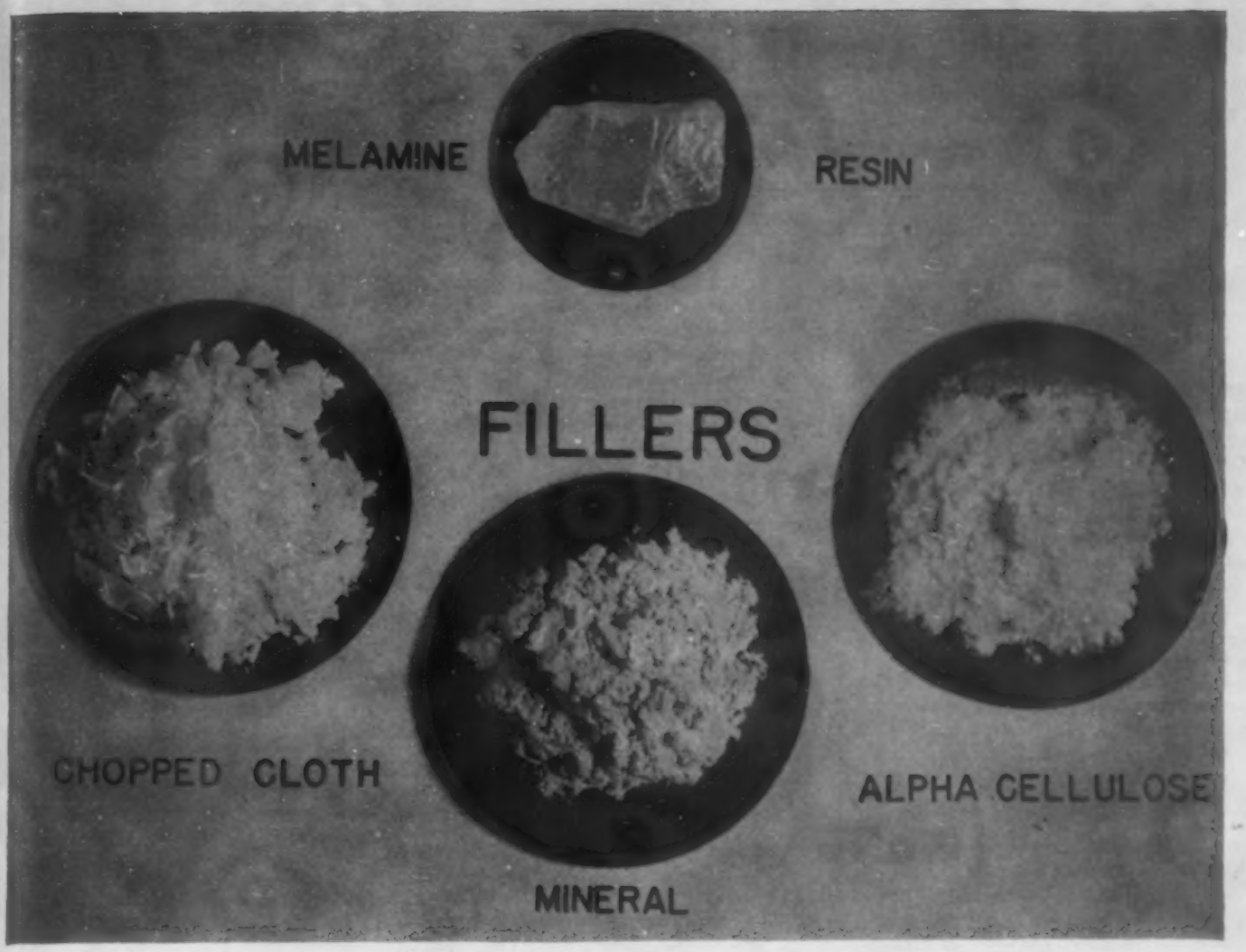
[c] From an unpublished report on repeated blow impact tests conducted at the Bell Telephone Laboratories.

(*Above*) **TABLEWARE FOR THE U. S. NAVY** molded of MELMAC® by The Bryant Electric Company has extreme surface hardness and resistance to moisture.

(*Below*) **ONE OF THE MOST COMPLICATED** modern plastic moldings is this MELMAC distributor housing for an 18-cylinder aircraft engine, transfer molded complete with the 25 inserts shown.

Life ON THE PLASTICS NEWSFRONT





(*Above*) **SELECTION OF THE FILLER** for Cyanamid's MELMAC plastics is determined by the properties desired in the finished molded product. The basic uncured resin is a colorless, glassy solid.

When combined with a filler of chopped cotton cloth, the molded material has high flexural strength, excellent shock resistance, very low moisture absorption, arc resistance and general inertness with regard to odor and taste.

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Mineral-filled MELMAC is designed for applications where arc resistance, high dielectric strength and heat resistance are of primary importance. Effective April 1, the price of mineral-filled MELMAC was reduced. Ask for further information on the Cyanamid plastic to fit your needs.

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TECHNICAL BRIEFS

Abstracts of articles on plastics in the world's scientific and engineering literature relating to properties and testing methods, or indicating significant trends and developments.

Engineering

HIGH-FREQUENCY HEATING FOR PLASTICS. British Plastics *15*, 322-326; 408 (Nov. and Dec. 1943). The theory and uses of this method for obtaining rapid and uniform heating of molding materials are discussed.

EMULSION POLYMERIZATION OF SYNTHETIC RUBBER IN 10-GRAM SYSTEMS. C. F. Fryling. Ind. Eng. Chem., Anal. Ed. *16*, 1-4 (Jan. 15, 1944). The experimental procedure consists of sealing the ingredients of a polymerization recipe into a test tube and rotating the tube at a constant temperature, following the course of the reaction by noting the decrease in volume of the system. The latex is removed for coagulation when the polymerization has proceeded as far as desired, and the yield is determined by weighing the dried stabilized coagulum.

SYNTHETIC BRISTLES AND ELECTROSTATIC EXCITABILITY. British Plastics *15*, 426-428 (Dec. 1943). Data are tabulated for electrostatic charging of synthetic bristles, including those made of polyvinyl chloride. Tests indicated that bristles which can become highly charged should not be used in proximity to explosive materials.

PRECAUTIONS IN THE USE OF CHLORINATED NAPHTHALENES AND DIPHENYLS. L. Greenburg. Chem. Ind. *54*, 68-69 (Jan. 1944). Recommendations for safe practice in working with chlorinated naphthalenes and diphenyls are given. These compounds, which are used extensively in conjunction with plastics, are highly toxic.

PLASTIC DIPPING. H. Forsberg. Iron Age *153*, 54-55 (Feb. 3, 1944). Metal parts are dipped in a molten ethyl cellulose plastic composition which encases them in tough transparent coats of plastic. These coats of plastic serve to protect the parts from the corrosive action of elements until they are ready for use. The films are easily stripped from the parts.

Chemistry

SALTS OF RESIDUAL DIMERIZED FAT ACIDS. J. C. Cowan and H. M. Teeter. Ind. Eng. Chem. *36*, 148-152 (Feb. 1944). The zinc, calcium and magnesium salts of residual dimerized fat acids are found to possess marked resinous properties; they are capable of forming fibers, films and viscous solutions. These properties are attributed to ionic association of divalent anions and cations into long chains. Approximate molecular weight determinations by viscometric methods indicate a value of about 15,000 in 10 percent solutions in pyridine. While fibers are apparently too weak to be of use, the film-forming properties have been utilized in the formulation of shellac substitutes and varnish—the latter having properties comparable with zinc resinate and ester gum varnishes.

PLYWOOD BONDING. H. Grinsfelder and M. R. Collins. Ind. Eng. Chem. *36*, 152-7 (Feb. 1944). A method for determining a minimum bonding time schedule applicable to a wide variety of plywood constructions and bonding conditions is described. See MODERN PLASTICS *21*, 111 (Oct. 1943).

Properties

A SURVEY OF PLASTICS. S. L. Smith. Engineer *176*, 491-492, 511-512, 529-530 (Dec. 17, 24, 31, 1943). The properties of laminated and reinforced plastics are described in detail. Sections are included on the use of reinforced plastics as structural materials and bearings, and on test methods employed in Great Britain.

EFFECT OF LOW TEMPERATURES ON YOUNG'S MODULUS OF ELASTOMERS. J. W. Liska. Ind. Eng. Chem. *36*, 40-46 (Jan. 1944). Data are presented showing the manner in which Young's modulus of both natural and synthetic rubber varies with temperature in the range 0 to −60° C. The results indicate that extremely long test periods are required for the investigation of physical changes resulting from low-temperature crystallization. The stocks having relatively high moduli at a given low temperature sometimes have very low brittle-point temperatures. The latter are, therefore, inadequate for use as indices of low-temperature serviceability.

OIL AND WATER ABSORPTION BY LAMINATED BUSHINGS. R. Nitsche. Kunststoffe *33*, 11-14 (1943). Cotton and staple rayon fabric laminates in the form of bushings were immersed in oil and in water, and the weight and dimensional changes determined for various intervals up to one year. Sample *A* was a laminated cotton fabric bonded with 50 percent cresol-formaldehyde resin by rolling and pressing and had a specific gravity of 1.33; sample *B* was a laminated staple rayon fabric bonded with 50 percent cresol-formaldehyde by rolling and pressing and had a specific gravity of 1.34; sample *C* was a laminated staple rayon fabric bonded with 60 percent cresol-formaldehyde by rolling only, and had a specific gravity of 1.25. The samples were tubes, 60 mm. inside diameter and 70 mm. outside diameter. Sample *A* was the most stable in oil and in water, and sample *B* was the least stable. The weight and dimensional changes of sample *B* were 2 to 3 times those of the other samples. The results indicate that the method of the German Industrial Standards, a short-time test at room temperature, does not give reliable results. Tests at 90° C., and 3 atmospheres for 140 hr. give results which agree with the long-time tests. The results obtained with bushings in metal collars were comparable with those obtained with loose bushings.

Testing

STRUCTURE AND BREAKING STRENGTH OF PLASTIC MOLDINGS. G. O. Grimm. Plastics *7*, 251-257 (June 1943). Fundamental factors affecting the production of representative test pieces designed for the investigation of the mechanical properties of thermosetting molding materials are surveyed. These include time, temperature, pressure, relative humidity and particle size.

THE CONTROL, SPECIALIZED TESTING AND USE OF SOME MODERN INSULATING MATERIALS. A. R. Dunton. J. Inst. Elec. Eng. (London) *90*, Part I, 463-470 (Nov. 1943). Methods for testing insulating materials are described. The tests are designed to evaluate: 1) resistance to moisture, 2) resistance to high and low temperatures, 3), resistance to alkalies, acids, solvents, oils, etc., and 4) fatigue properties and impact strength as well as the usual tests for electrical properties. A method of testing the moisture resistance of insulating varnishes is described in which the varnish is applied to a metal plate or to absorbent paper, the specimen clamped between 2 hollow electrodes which are then filled with water and a direct current stress of 250 or 500 volts applied. The time required for failure is noted. The results indicate that: 1) pigmented varnishes are superior to clear varnishes, 2) addition of drying agents is detrimental, 3) oil-modified phenol and alkyd resins give very good results, 4) blends of gilsonite with china wood oil or linseed oil give good results, 5) multiple dips are superior to single dips in thick lacquer and 6) baked coatings are superior to air-dried materials. Practically all the methods are cited from British Standards Specifications which are referenced in tabular form. The materials considered are plastics, papers, fabrics, rubbers, oils, varnishes and micas.

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PLASTICS DIGEST

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General

THE THEORY OF ADHESION. L. Van Roy. Paper Ind. *25*, 1102–1104 (Jan. 1944). A theory for specific adhesion is that strong bonds are obtained only when the adhesive and the material to which the adhesive is applied are of the same polar nature. Thus, paper and animal glues make strong bonds because they are both strongly polar, and water which is strongly polar makes a very strong bond to polar material when frozen, but weak bonds with nonpolar materials. Therefore, it follows that in specific adhesion the molecular attraction between the adhesive and the adherent is responsible for the strength of a particular joint or bond.

ARTIFICIAL BRISTLES FROM CASEIN. T. L. McMeekin. ASTM Bulletin No. 125, 19–21 (Dec. 1943). Casein containing 45 percent water is extruded into air with subsequent stretching and hardening with quinone solution followed by formaldehyde while under tension. The fibers are usually stretched only twice their length in order to obtain an optimum combination of strength and flexibility. A number of brushes, such as paint, hair, shaving and counter brushes, have been made of the casein bristles. They have also been suggested for furniture stuffing and other forms of padding.

PLASTICIZERS AND THEIR APPLICATIONS. H. Barron. Plastics *7*, 449–459 (Oct. 1943). The properties of important commercial plasticizers, choice of plasticizers for use with specific plastics and theories regarding the action of plasticizers are reviewed.

Materials

PREPARATION, PROPERTIES AND POLYMERIZATION OF ACRYLIC ESTERS. C. H. Fisher. ASTM Bulletin No. 125, 22–23 (Dec. 1943). Work at the Eastern Regional Research Laboratory on acrylic esters is described. The method for converting carbohydrates into methyl acrylate consists of fermenting them to lactic acid, reacting this with methanol and acetic anhydride to make methyl acetyl lactate, and heating this at about 550° C. Emulsions of polyacrylic esters are useful for coating paper, cloth, glass, concrete and other materials, and as a substitute for rubber latex.

SPRAY DRYING SPEEDS RESIN PRODUCTION. Chem. Ind. *54*, 52–53 (Jan. 1944). The process of spray-drying resins to produce a dry powder suitable for packaging is described. Hot air and the molten resin are introduced through an atomizer into the top of a large drying chamber. Cold air is introduced into the bottom. A sweeper in the chamber sweeps the powdered resin into the ducts which carry the mixture of resin and air to collectors. The resin is then deaerated and packed.

"ALKATHENE," A POLYTHENE PLASTIC. British Plastics *15*, 417–418 (Dec. 1943). The properties of a polythene plastic prepared by subjecting ethylene to extremely high pressures under controlled polymerizing conditions are described. "Alkathene" is the trade name of Imperial Chemical Industries, Ltd.

Molding and fabricating

DETECTION AND ELIMINATION OF COMMON FAULTS IN PLASTIC MOLDINGS. W. M. Halliday. Plastics *7*, 467–476 (Oct. 1943). The classes of faults are considered in two groups: material and molding. Topics discussed for thermosetting compounds include heavy flash, incomplete moldings, blistering, sticking, bloom, chalk-like surface, softness, wavy surface and opaque spots. Faults in thermoplastics include flash, surface marks, bubble-like projections, incomplete moldings and overheating. Faults in molding are discussed under the headings: mold design, cavity disposition, heating and cooling, and attachment of mold to press.

WORKING METHODS FOR PVC MATERIAL. G. Wick and A. Iloff. British Plastics *15*, 299–305 (Oct. 1943). Two new molding methods developed for fabricating polyvinyl chloride into finished shapes are described. One of these is impact compression molding, in which the material at 160° C. is forced from a worm press into an impact molding press which remains closed until the molded article has reached 60–70° C. The other is a modified injection molding machine adapted to the less freely flowing polyvinyl chloride compound.

Applications

PRESERVATION OF HUMAN AND ANIMAL TISSUES. M. M. Strumia and J. I. Hershey. Science *99*, 105–106 (Feb. 4, 1944). A method for preserving tissues in ethyl methacrylate resin is described. The vacuum-impregnated mass is polymerized at 40 to 70° C. in a period of 2 days or more. The block is finally annealed at 100 to 115° C. for a half hour to prevent crazing. Exact directions for the impregnation and polymerization are given. The organs imbedded retain their original size, shape and normal texture; the color is somewhat less brilliant but still satisfactory if the period of polymerization was not too long.

SPECIFIC GRAVITY AND HOUSING. R. V. Boughton. Plastics *7*, 533–538 (Dec. 1943). The problem of weight and its effect on the selection of building materials are considered by a building consultant.

MODERN PLASTICS FOR INSULATION. Julius Veit. British Plastics *15*, 353–360 (Nov. 1943). The present and future possibilities of polyvinyl chloride as applied in the electrical industry are reviewed, especially the use of insulated cables and wires in postwar prefabricated housing.

BASIC ADVANTAGES OF ALL-PLASTIC DIES AND DIE-SETS. D. Cook. Aero Digest *44*, 106, 108 (Feb. 1, 1944). The advantages of plastic dies and die-sets are discussed. The production of dies from a lignin plastic and laminated phenolic plastics is described.

Coatings

UREA-FORMALDEHYDE WATER-THINNED PAINT. J. K. Wise. Ind. Eng. Chem. *36*, 144–147 (Feb. 1944). Highly washable water-thinned paints have been prepared from cold-setting urea-formaldehyde resins. It is essential to choose the pigments and fillers properly in order that the cure of the resin shall not be inhibited. A satisfactory test method has been developed for the evaluation of pigments and fillers. In the usual commercial paint pigments and extenders the phenomenon of inhibition of cure seems to be a surface problem rather than a chemical reaction between the accelerator and the pigment used.

ANTI-FOULING AND ANTI-CORROSIVE COMPOSITIONS. J. H. Davey. Metal Finishing *42*, 60–63 (Jan. 1944). The various forms of marine life which grow on the bottoms of ships are described. The coating materials which are designed to stop this growth function by establishing an antiseptic condition in the neighborhood of the hull. The poisons slowly dissolve out of the coatings. The most effective materials are able to kill marine organisms while still in the embryonic condition; they are not poisonous to the growth once it has been established. The plastic materials in the coating are designed to control the rate at which the poison dissolves; the poison must dissolve fast enough so that the organisms are killed before they attach themselves to the hull and yet slow enough that recoating is not necessary at too short intervals. The poisons in common use are compounds of copper and mercury. Arsenic is also used.

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CURING CATALYST. G. F. D'Alelio and J. Underwood (to General Electric Co.). U. S. 2,338,492, January 4. An acid curing resin is cured by means of a triazinyl carboxy-alkyl sulfide or a soluble, fusible aldehyde reaction product thereof.

POLYMERS. R. Kitani and N. Takashima (to General Electric Co.). U. S. 2,338,517, January 4. A polymeric compound, such as a vinyl polymer, is purified by adding a coagulating agent to an aqueous emulsion of the polymer.

MODIFIED PHENOLIC RESIN. I. Rosenblum. U. S. 2,338,543, January 4. Oil-soluble resin is prepared by condensing phenol, substituted by a hydrocarbon radical, with formaldehyde in the presence of alkaline catalyst, condensing further until a liquid condensate separates on acidification, acidifying, and then heating with rosin in the presence of strong mineral acid.

CELLULOSE ESTERS. W. O. Kenyon and E. C. Yackel (to Eastman Kodak Co.). U. S. 2,338,587, January 4. Partially hydrolyzed lower fatty acid esters of cellulose are rendered alkali reactive by treating with nitric acid anhydride and 1–10 percent moisture.

RESIN. W. Gündel (to Hydronaphthene Corp.). U. S. 2,338,637, January 4. A resin is formed by condensing dicyandiamidine, dicyandiamidine sulfate and formaldehyde.

CELLULOSE ETHER. L. H. Bock and A. L. Houk (to Rohm and Haas Co.). U. S. 2,338,681, January 4. The process of preparing cellulose ethers having both oxycarbamylethyl and oxycarboxyethyl groups.

COMB. E. R. Person (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,338,735, January 11. A comb is injection molded by introducing the molten material into the mold cavity at a point located between the adjacent surfaces of two teeth.

STYRENE COPOLYMERS. F. J. Soday (to United Gas Improvement Co.). U. S. 2,338,741–2–3, January 11. A light oil ring substituted methyl styrene is copolymerized with a partially polymerized butadiene, isoprene or piperylene.

STRIP MATERIAL. C. W. Leguillon (to B. F. Goodrich Co.). U. S. 2,338,770, January 11. Strip plastic material is fed through a cooling bath.

MOLDED ARTICLE. A. E. Ushakoff (to United Shoe Machinery Corp.). U. S. 2,338,787, January 11. A shrinkable article is prepared from a solution of plastic material which gels on cooling by placing in a cool mold, and removing while the liquid from syneresis provides lubrication.

MOLD. F. F. Ellingwood (to Bakelite Corp.). U. S. 2,338,806, January 11. A bored article is prepared by placing a liquid resin in a mold and heating.

ALLYL RESINS. W. Bauer and F. Götz (to Alien Property Custodian). U. S. 2,338,893, January 11. Allyl chloride or a homologue is heated under reflux for several days in the presence of a polymerization catalyst.

VARNISH. P. Kümmel (to Alien Property Custodian). U. S. 2,338,948, January 11. A varnish comprising chlorinated rubber, methylisopropyl benzene and ethyl lactate.

ACRYLIC ESTER RESINS. M. A. Pollack (to Pittsburgh Plate Glass Co.). U. S 2,338,967, January 11. A polymer of an ester of a polyhydroxy alcohol and alpha chloroacrylic acid.

VINYL RESIN. J. K. Craver (to Monsanto Chemical Co.). U. S. 2,339,056, January 11. A plastic composition comprising a polyvinylacetal resin modified with 2 plasticizers, one of which is an alkylamide primary plasticizer.

COATING. G. F. D'Alelio (to General Electric Co.). U. S. 2,339,058, January 11. A composition comprising a partially polymerized diallyl ester of a dicarboxylic acid and an allyl ester.

THERMOSETTING RESIN. G. F. D'Alelio (to General Electric Co.). U. S. 2,339,059, January 11. A thermosetting resin containing an acid curing agent.

RESIN. G. F. D'Alelio (to General Electric Co.). U. S. 2,339,061, January 11. The reaction products of an aldehyde and poly (diazinyl hydrazino) derivatives of polycarboxylic acids.

VINYL ESTERS. H. T. Neher and W. R. Conn (to Rohm and Haas Co.). U. S. 2,339,184, January 11. Aqueous dispersions of polyvinyl acetate are stabilized by removing unreacted vinyl acetate by alkalizing and heating to induce partial hydrolysis.

TUBES. J. N. Whitehouse. U. S. 2,339,211, January 11. An apparatus for forming tubes from strips of plastic material.

POLYAMIDES. M. M. Brubaker, D. D. Coffman and F. C. McGrew (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,339,237, January 18. A polyamide composition having high melting point and enhanced affinity for dyes is prepared by heating together 2 or more preformed linear polyamides, one of which is water soluble, until the molten mixture forms a single phase and until a homogeneous product is formed on solidification.

VARNISH. E. B. Kester (to Koppers Co.). U. S. 2,339,271, January 18. A varnish comprising a resin formed by reacting naphthalene and formaldehyde and then reacting the resinified naphthalene with a phenol and adding a drying oil and a solvent.

RESIN. W. Zerweck and M. Schubert (to Alien Property Custodian). U. S. 2,339,314, January 18. A resin is prepared by condensing an aldehyde with a 5-membered heterocyclic ring compound such as 2-aminothiazole, 4-methyl-2-aminothiazole, 4-phenyl-2-2-mercapto-4-methyl-2-phenylamino-thiazole and 2-mercapto-4-hydroxythiazole, which resinous products are thermosetting.

RESIN. R. D. Snow (to Phillips Petroleum Co.). U. S. 2,339,362, January 18. In production of an olefin-sulfur dioxide resin, the resin is treated with vapors of an organic solvent which in the liquid phase is capable of dissolving the resin.

VINYL POLYMER. R. Endres (to Alien Property Custodian). U. S. 2,339,387, January 18. An insulating material containing a polymerizate of vinyl chloride and vinyl acetate and a dialkyl ester of adipic acid.

LENS. H. C. Staehle (to Eastman Kodak Co.). U. S. 2,339,433, January 18. A lens of accurate curvature is formed by molding, under heat and pressure, a polymerized plastic into a lens blank having a surface of the desired curvature, relieving

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releasable strains, correcting the discrepancy by adding a thin substantially unpolymerized layer of the same material to the surface and polymerizing it.

SHEET MATERIAL. J. Bailey and R. S. Jesionowski (to Plax Corp.). U. S. 2,339,451, January 18. A sheet of solvent-free organic thermoplastic material is prepared by continuously extruding the material through a nozzle to form a flat ribbon, gripping the edges of the ribbon and stretching transversely to widen it.

PLASTIC SLUGS. J. Bailey and R. S. Jesionowski (to Plax Corp.). U. S. 2,339,452, January 18. A mold cavity is filled with an inert gas at a pressure greater than that at which the gas phase of the material forms; polymerized material is injected into the mold until filled, thus expelling the gas which is maintained under the same pressure; and finally the plastic material is cooled under the pressure applied for injection.

ABSORBENT MATERIAL. W. Eustis (to Kendall Co.). U. S. 2,339,562, January 18. An absorbent body is prepared by uniting water-wettable textile fibers with insoluble non-wettable synthetic resin.

BOOK COVER. R. J. Roberts (to Farley and Loetscher Mfg. Co.). U. S. 2,339,586, January 18. Book cover, comprising a pair of relatively thick sets of sheets of fibrous material impregnated with a synthetic resin composition.

MOLDING MATERIAL. G. Smith (to Reed-Prentice Corp.). U. S. 2,339,607, January 18. Molding material is heated by effecting dielectric losses sufficient to render the interior plastic while simultaneously retaining a firm, non-tacky skin by maintaining the surface at a low temperature.

CONDENSATION PRODUCTS. G. F. D'Alelio (to General Electric Co.). U. S. 2,339,621-2-3, January 18. The reaction product of melamine, formaldehyde and an aliphatic polyamino sulfide or oxide; of an aldehyde and a bis-triazine derivative; and of an aldehyde and a carbamidomethyl derivative of a 2,4,6-triamino-1,3,5-triazine.

CELLULOSE ESTERS. C. L. Fletcher and A. W. Crane (to Eastman Kodak Co.). U. S. 2,339,631, January 18. Cellulose esters having high acyl contents are precipitated from their reaction mixtures by means of a bath having a large water content so that a loose penetrable product is obtained.

SYNTHETIC RESINS. G. F. D'Alelio (to General Electric Co.). U. S. 2,339,768-69-70, January 25. The condensation products of substituted polyamines with a reaction product of an aldehyde and a cyclic amidine, or with themselves.

COATING. H. F. Ether (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,339,775, January 25. A coating comprising a vinyl halide polymer, a pigment and a substance such as lecithin or cephalin.

MOLD. S. Milano (to Maryland Plastics, Inc.). U. S. 2,339,792, January 25. A sectional mold for producing plastic buttons.

SHEET MATERIAL. A. J. Daly and W. G. Lowe (to Celanese Corp. of America). U. S. 2,339,840, January 25. Sheet material is prepared by casting a thermoplastic resin upon a metal alloy which melts below 100° C., drying, and heating so as to melt the alloy without damaging the sheet material.

CELLULOSE DERIVATIVE. W. E. Hanford and D. F. Holmes (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,339,913, January 25. A cellulosic material is impregnated with a solution in an inert solvent of a compound having several $\cdot N{:}C{:}X$ groups, wherein X is a chalcogen, and finally baked.

RUBBER CHLORIDE. J. W. Raynolds (to Raolin Corp.). U. S. 2,339,945, January 25. An anhydrous rubber solution is chlorinated, purified to reduce nitrogen content by adding finely divided material which adsorbs nitrogenous material, and the rubber chloride is separated.

RESIN COMPOSITION. W. J. Sparks (to Jasco, Inc.). U. S. 2,339,958, January 25. A composition comprising polyethylene, polyisobutylene and wax.

CONDENSATION PRODUCT. G. F. D'Alelio (to General Electric Co.). U. S. 2,340,044-5-6, January 25. The reaction product of melamine, formaldehyde and a tri-(monocarbamidomethyl)amine; the reaction product of an aldehyde and a dipolyamine.

CELLULOSE ETHERS. R. C. Medl, Jr. (to Hercules Powder Co.). U. S. 2,340,072, January 25. An aqueous coating solution comprising a water-soluble cellulose ether and a water-soluble alkaline reacting salt of a polybasic acid.

THERMOSETTING RESINS. G. F. D'Alelio and J. W. Underwood (to General Electric Co.). U. S. 2,340,107, January 25. A composition of an acid-curing thermosetting resin having included a catalyst comprising a pyrimidyl halogeno cyanoalkyl sulfide.

RUBBERLIKE COMPOSITION. G. F. D'Alelio (to General Electric Co.). U. S. 2,340,108, January 25. A composition comprising a polyvinyl halide or polyvinylidene halide and di-(cyclohexyl) itaconate.

COPOLYMER. G. F. D'Alelio (to General Electric Co.). U. S. 2,340,109, January 25. The copolymerization product of a soluble, fusible, heat hardenable polymer of divinyl benzene and an unsaturated alkyd resin.

ION EXCHANGE RESIN. G. F. D'Alelio (to General Electric Co.). U. S. 2,340,110-1, January 25. Cations are removed from liquids by contacting with a mass comprising an insoluble, infusible, copolymer of a polymerizable mixture of a compound containing a vinyl group and at least one other polymerizable group and a similar mass containing in addition an acrylic acid.

COLD MOLDING RESINS. W. R. Heineman (to General Electric Co.). U. S. 2,340,123, January 25. A cold-molding compound is prepared by adding at room temperature a glue solution to a liquid phenolaldehyde resin obtained by reacting at reflux a phenol and formaldehyde in the presence of an alkaline earth hydroxide.

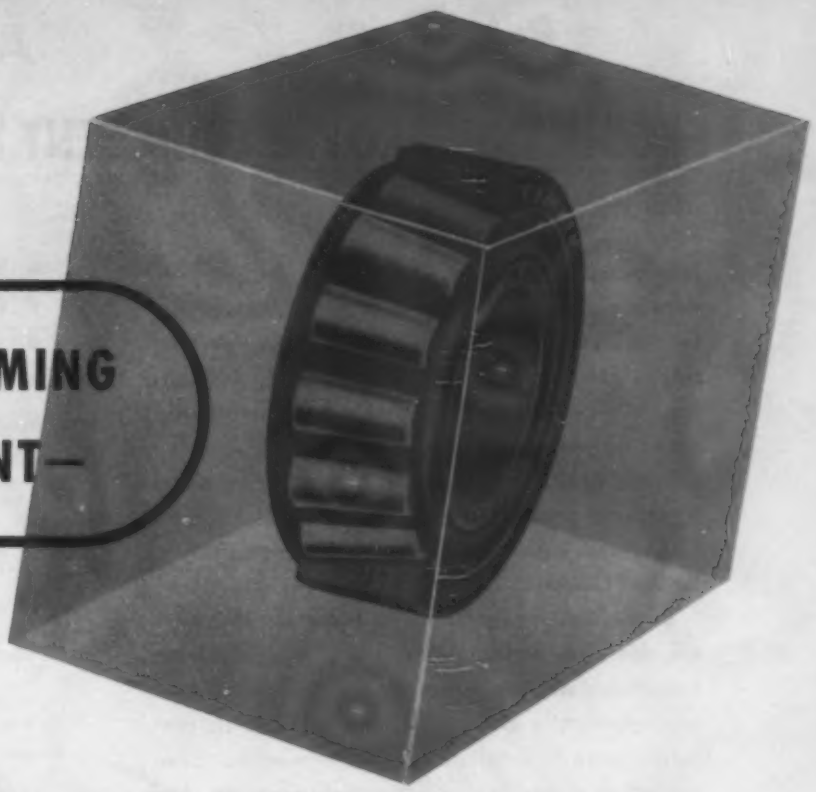
VINYL RESIN. R. W. Staley (to General Electric Co.). U. S. 2,340,151, January 25. A composition comprising the polymerization product of a vinyl halide and a heat and light stabilizer comprising a lead salt of an aliphatic acid and an aryl alcohol.

CELLULOSE ETHERS. H. Dreyfus (to Celanese Corp. of America). U. S. 2,340,177, January 25. Cellulose ethers are prepared by impregnating cellulose at atmospheric temperature with a saturated solution of a caustic alkali, reacting with a lower alkyl etherifying agent, adding solid caustic alkali and a further amount of etherifying agent and continuing until the desired product is obtained.

POLYVINYL BUTYRAL. L. E. Cheyney (to Wingfoot Corp.). U. S. 2,340,259, January 25. A reaction product of polyvinyl butyral and an alkyl para toluene sulfonate.

COATING. J. D. Murray. U. S. 2,340,338, February 1. A coating comprising acetylated starch, chlorinated diphenyl resin and plasticizers comprising dimethoxy ethyl phthalate and diphenyl phthalate.

COUMARONE-INDENE RESINS. E. L. Cline and D. F. Gould (to Allied Chemical and Dye Corp.). U. S. 2,340,413, February 1. In a process for producing coumarone-indene resins by continuous catalytic polymerization of a coumarone indene resin oil, a controlled proportion of the reaction product is recycled to the polymerization reaction zone.



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PLASTICS EQUIPMENT—

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Basically the plastics industry is no different from any other as far as the need for Timken Bearings is concerned. Applications may differ in detail due to the specialized nature of some of the equipment, but fundamentally the service requirements are the same namely, elimination of friction; carrying of radial, thrust and combined loads; and holding moving parts in correct and constant alignment.

Timken Tapered Roller Bearings offer manufacturers and users of plastics machinery the same operational advantages they have brought to one industry after another during the past 25 years—higher speeds, greater accuracy, increased endurance, reduced maintenance costs. It will pay you well to have them at every suitable position in the equipment you make or buy. The Timken Roller Bearing Company, Canton 6, Ohio.

ANNOUNCING

PRODUCTION-PROVEN EQUIPMENT FOR THE PLASTICS INDUSTRY

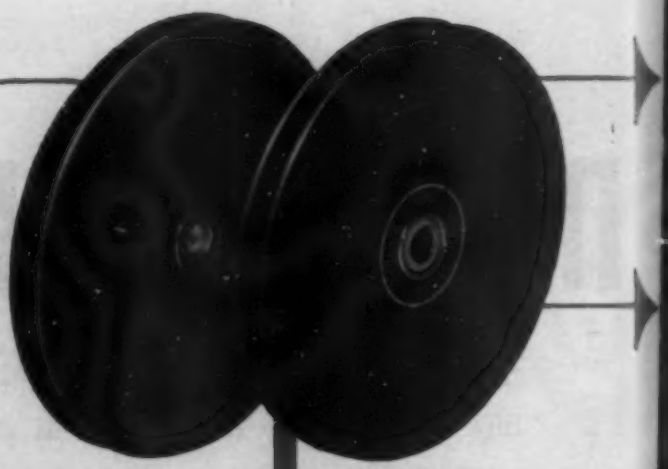
The Induction Heating Corporation, largest producers of electronic heat treating equipment for ferrous and non-ferrous metals and alloys, are constantly at work, in many fields, devising, developing and pioneering new methods to assist and speed up production.

In the field of plastics we have deferred making any formal announcement of this equipment's possibilities until such time as thoroughly tested results justified claims.

In the early part of 1943 Induction Heating's engineers, in collaboration with those of Plastic Manufacturers, Inc., developed a dielectric heater unit specifically designed to pre-heat plastic preforms. Since its installation this equipment has been subject to a steady day after day operation. And now that proofs of its production have *time* behind the *figures* it can be conclusively stated that Thermonic dielectric heating is a tremendous advancement in the art and practice of compression molding.

Thermonic dielectric heating not only offers you a guaranteed source of high frequency energy, but *guaranteed performance* backed by the services of a staff of engineers who specialize in the utilization and adaptation of this energy to your own particular plastic problem.

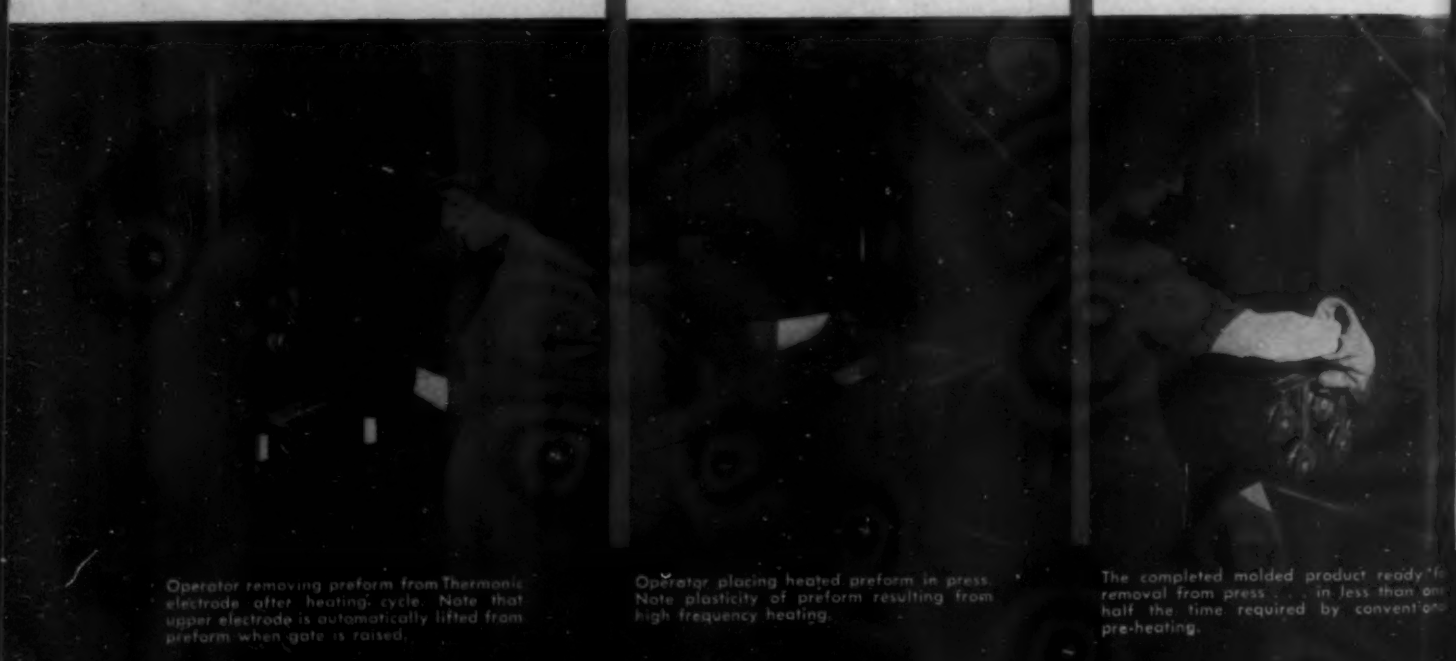
- REDUCES PREHEAT TIME
- REDUCES PRESS CLOSING TIME
- REDUCES CURING TIME
- REDUCES MOLDING PRESSURE
- REDUCES REJECTS
- IMPROVES MOLDING ACCURACY



Ball bearing aircraft pulleys molded by

PLASTIC MANUFACTURERS, INC.

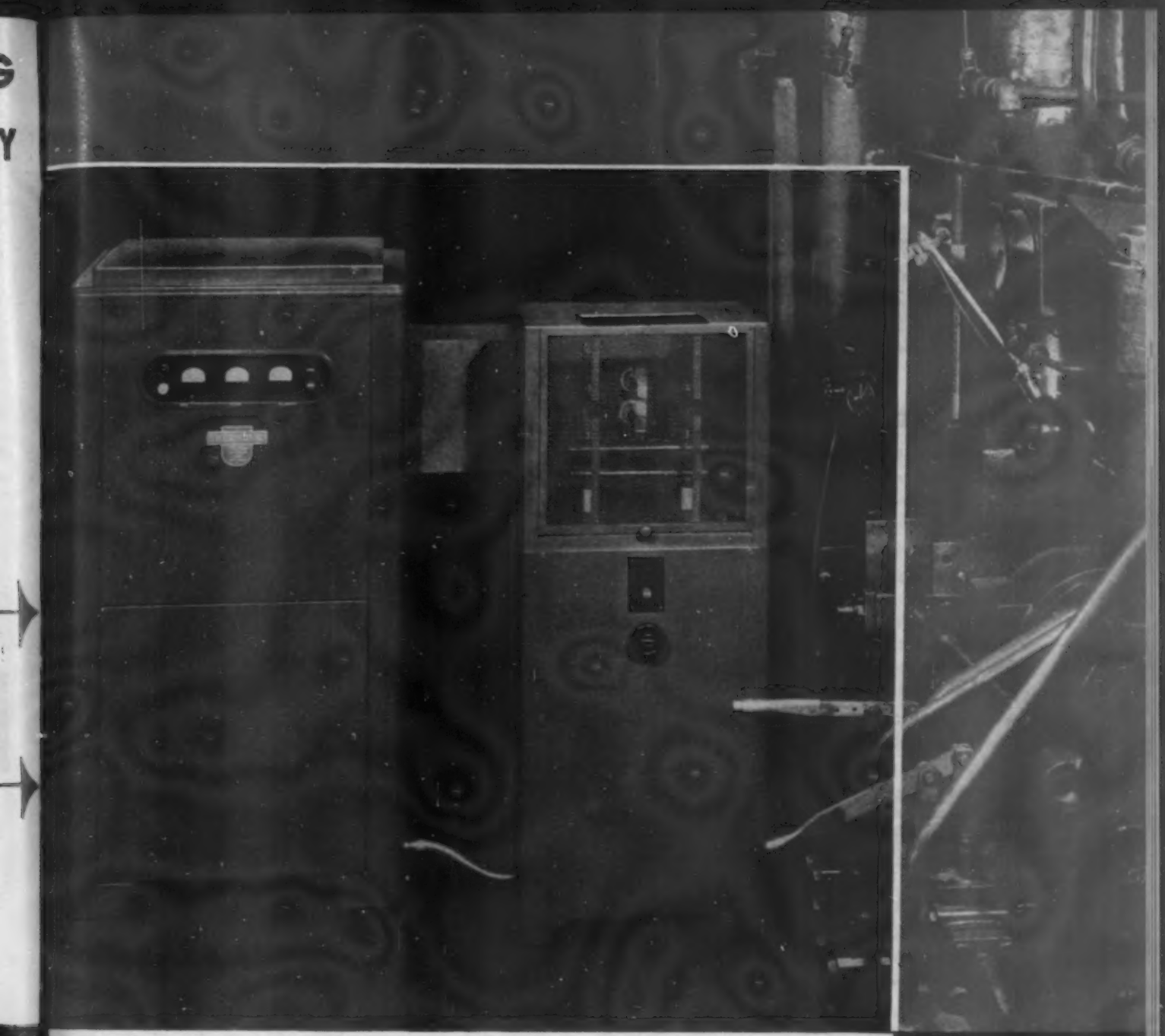
STAMFORD, CONN.



Operator removing preform from Thermonic electrode after heating cycle. Note that upper electrode is automatically lifted from preform when gate is raised.

Operator placing heated preform in press. Note plasticity of preform resulting from high frequency heating.

The completed molded product ready for removal from press . . . in less than one-half the time required by conventional pre-heating.



THERMONIC

THE MOST EFFICIENT AND ECONOMICAL SYSTEM FOR DIELECTRIC HEATING

INDUCTION HEATING CORPORATION • 389 LAFAYETTE ST., NEW YORK 3, N.Y.

Largest Producers of Electronic Heat Treating Equipment

Resimene

A NEW ADDITION TO

for vital war jobs now

HERE is an answer to the urgent need for an easily molded plastic with high arc resistance — Resimene 803A, a cellulose-filled melamine-formaldehyde compound with the electrical properties of a melamine and the moldability of a general purpose phenolic.

Developed specifically for AN connector inserts formerly molded from a general purpose phenolic, Resimene 803A will also prove useful in many aircraft ignition parts and wherever an electrical insulation is needed to withstand the higher voltage differentials and severe operating conditions commonly met by World War II electrical equipment.

In tests of its arc resistance with ASTM-D495-42 electrode spacing at a current density of about ten milliamperes, Resimene 803A showed no breakdown after 2,000 flashes of one-quarter second duration . . . while the phenolic formerly used breaks down under two to three arc flashes. Under low atmospheric pressure equivalent to 10,000 feet altitude at the electrode spacing given in the AN connector specifications, Resimene 803A showed no breakdown after more than 200 flashes . . . while the phenolic failed after two or three.

Most remarkable feature of Resimene 803A, however, is the fact that this very substantial increase in arc resistance has been achieved *without sacrificing moldability or other important properties.*

In production molding trials on the AN connectors, Resimene 803A proved fully as easy to handle as the general purpose phenolic formerly used, so that previous production rates were maintained.

Mold shrinkage and after shrinkage are exceptionally low for a melamine material, and, as you would expect, water absorption is low and abrasion resistance high.

Resimene 803A is allocated by WPB and is available only for direct military applications. *Samples and trial orders up to fifty pounds, however, can be supplied without specific allocation.*

RESIMENE 803A

PHYSICAL PROPERTIES

Specific gravity: 1.44
Water absorption, after 24 hrs. immersion: 0.51%
Mold shrinkage, no preheat: 0.008 in. per in.
After shrinkage, 8 hrs. at 220°F.: 0.002 in. per in.
Flexural strength: 12,900 PSI
Deflection, at yield: 0.066 inch
Compressive strength: 32,700 PSI
Deformation: 0.130 inch
Impact strength, Izod test: 0.34 ft. lbs. per in. of notch
Abrasion resistance, Taber: 1/6.8 x Std. phenolic

ELECTRICAL PROPERTIES

Dielectric strength, 60 cycles, short-time: 390 VPM
60 cycles, step-by-step: 320 VPM
Arc resistance, ASTM-D495-41: 120 seconds
Volume resistivity: 2.7×10^{16} ohms/ in 3
Surface resistivity: 6.0×10^{10} ohms/ in 2
Overall resistance: 6.0×10^{8} ohms
Power factor, 1 KC: 0.034
50 KC: 0.026
1 MC: 0.060
Dielectric constant, 1 KC: 8.0
50 KC: 6.7
1 MC: 4.7

These properties were determined using ASTM methods on standard sized test pieces molded under carefully controlled conditions and are therefore indicative of the properties of articles molded from this powder. However, such properties are materially affected by the size and shape of the piece and by variations in molding conditions and therefore no guarantee is implied that all articles molded from this powder will have the properties listed above.

THE FAMILY OF MONSANTO PLASTICS

for many more jobs postwar

MORE new jobs for plastics . . . in vital war equipment now . . . in important consumer goods postwar.

Those are results you can count on from the new Resimene (melamine-formaldehyde) molding compounds and industrial resins.

In addition to providing the unequalled arc resistance and other excellent electrical properties which make them so important in war applications now, the Resimenes have a unique combination of properties which will make them equally important once peacetime production is resumed:

- high heat resistance, close to the phenolics
- wide color range, from translucent white to opaque black
- low water absorption
- good acid and alkali resistance
- good resistance to boiling water
- odorless, tasteless, inert to organic solvents
- hard, permanent surface with excellent abrasion resistance
- high tensile and compressive strength
- good flexural strength
- excellent molding qualities.

In other words, here is a group of molding compounds and resins which should definitely be considered in your postwar planning. A glance at the column to the right will give you a brief list of some of the jobs you can expect Resimene to fill . . . but a second glance at the list of basic properties above will probably suggest many more.

For more details write: MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield 2, Massachusetts.

How you can use Resimene—postwar

Superior electrical properties will continue to be important in parts for aircraft and automobile ignition systems, circuit breakers, terminal blocks, telephone handsets, etc.

Resimene's wide color range and resistance to boiling water will make it an ideal material for buttons, buckles and many other large volume items.

Excellent resistance to acids, alkalis and boiling water plus Resimene's color range and high abrasion resistance should lead to molded tableware and kitchenware.

Still another postwar possibility is incandescent light fixtures molded from Resimene. Here color range, heat resistance, moldability would all be useful characteristics.

Resimene's ability to stand up under constant handling and exposure to weather plus its color range should make it possible to mold colorful, durable building hardware.

Resimene bonding resins for plywood, fabrics and paper will be useful wherever a colorful surface with good abrasion and excellent weather resistance is desired.

You will also probably see molded resin-fibre materials in which lower-cost phenolics will be combined with Resimene resins for a colorful and durable surface.

The broad and versatile family of Monsanto Plastics includes: Lustron polystyrenes • Monsanto vinyl acetals • Nitron cellulose nitrates Fibestos cellulose acetates • Opalon cast phenolics • Resinox phenolic compounds and Resimene melamine compounds. Forms in which they are supplied include: Sheets • Rods • Tubes • Molding Compounds Castings • Industrial Resins • Coating Compounds • Vuepak Rigid, Transparent Packaging Materials.

MONSANTO PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

The quality of any stearate depends upon the quality of the metallic oxide and the stearic acid used in its composition—but the stearic acid is the primary factor. One reason behind the success of Witco Calcium and Zinc Stearates, as plastics lubricants, is that only Witco Stearic Acids are used in their production. The advantage of using these high quality stearic acids can be seen in the exceptional purity, and the even, fluffy texture of the resulting products. Try Witco Stearates. You will secure better and more economical results. Write for samples and further details.

WITCO CHEMICAL COMPANY MANUFACTURERS AND EXPORTERS

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For Purpose of Identification

—and as Proof of Quality

Consolidated adopts a new mold mark! . . . and though its reproduction will be no larger than the mark left by an ejecting pin, its modest, inconspicuous presence on the finished product is to serve as a guarantee of Consolidated precision-quality. It assures "Your Blueprint in Plastic".

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MOLDED PRODUCTS *Corporation*

309 CHERRY STREET, SCRANTON, PA.

FROM THE WHALE'S BELLY—1944 VERSION

In everything of Uncle Sam's that "flies, floats or shoots," National Vulcanized Fibre and Phenolite, laminated Bakelite, are playing a vital part. This is because of their lightness in weight, dielectric strength, ready machineablility, exceptional wearing and other qualities.

YANKS in Tanks, guns ablaze spewing forth in face of fire on enemy beachheads . . . that's the 1944 war saga of the sea.

The role of the LST (Landing Ship Tank) the modern whale, is to put men, equipment and supplies on the beach in the right order for successful invasion. The right order in which the LSTs, the tanks, and a great amount of our fighting equipment operate in turn, is dependent upon thousands of parts made of plastics, like National Vulcanized Fibre and Phenolite, laminated Bakelite.

We salute America's designing engineers who have developed our highly effective landing craft.

NATIONAL VULCANIZED FIBRE CO.

WILMINGTON DELAWARE

Offices in Principal Cities

LIKE WATER
OFF A DUCK'S BACK

Metal plated plastics

..ELIMINATES ABSORPTION

● The practicability of plastics to many manufacturers depends upon absorption or non-absorption. The Monroe method of plating plastics with metals entirely eliminates absorption.

The Monroe Auto Equipment Co. has produced innumerable metallic products for other companies for more than a quarter of a century. More recently we have devoted much time and effort to plating plastics and given constant study to such subjects as: **ABSORPTION . . . CORROSION . . . FLEXURAL STRENGTH . . . DIMENSIONAL STABILITY . . . ELECTRICAL SHIELDING . . . IMPACT STRENGTH.**

Our long experience assures you that we would not recommend the plating of plastics wherever metals would do the job as well.

We are anxious to work with your designers and engineers in developing plated plastics for your products.

The application of plated plastics is so extensive that we are not going to try to enumerate them.

Any metal that can be electroplated can be successfully applied to plastics by our process.

Write for our bulletin containing information on "Plated Plastics."

WHEN YOU THINK OF
METAL PLATED PLASTICS, THINK OF—

MONROE AUTO EQUIPMENT COMPANY

PLASTICS DIVISION

MONROE, MICH.

CHICAGO MOLDED PRODUCTS CORP.

TELEPHONE CAPITOL 1020
1020 NORTH KOLMAR AVENUE
CHICAGO 51. ILL.

An open letter to
our friends in Industry:

Twenty-five years ago this organization began rendering a needed service to industrial users of plastics. During this past quarter of a century it has been our privilege to work with hundreds of industrial leaders in the design and production of molded plastic parts.

That we have grown from a modest shop to become the largest custom molder in the Middle West is due, in no small part, to the valuable help we have had from our friends in industry.

So, as we celebrate our Silver Anniversary, we take this means of expressing our sincere appreciation for this help: first, to our customers, for their confidence and continued patronage; second, to our material suppliers, who have made our problems theirs; and last, to the other plastic molders who have so freely cooperated in the exchange of ideas and knowledge. To all of these go our heartfelt thanks with the hope that we may, in some measure, return the help and encouragement they have extended.

Sincerely yours,

Edw. F. Bachner

President

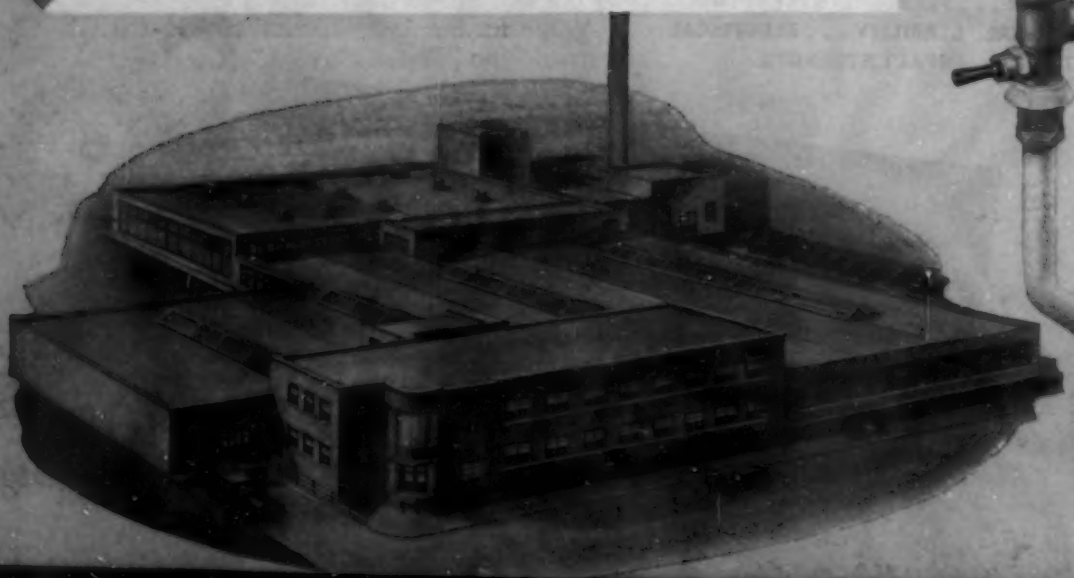
First Molded plastic washing machine agitator *(Meadows Corp.)*

First Molded plastic radio cabinet *(Kadette)*

First Instrument keys and stops of molded plastic *(Hammond Inst. Co.)*

First Successful one-piece molded plastic radio mast *(Curtiss-Wright)*

First Flush valve with liner and nine other parts molded of plastics *(Sloan Valve Co.)*



The Importance of Choosing the *RIGHT CUSTOM MOLDER*

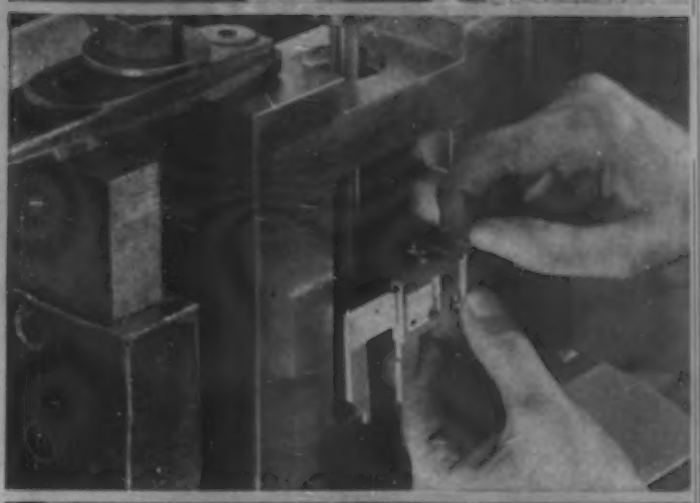
In planning any molded plastic job, the most momentous question you're faced with is your choice of custom molder. Fortunately, you'll find more than one who can meet every requirement. But remember . . . your molder bears the entire responsibility for the production of a vital part of your product . . . for solving engineering problems . . . building molds . . . running the job . . . finishing each piece . . . and feeding it into your production lines as your schedule demands.

Here at Chicago Molded, with the largest and best equipped custom molding plant in the Middle West, we offer a complete service . . . designing, engineering, mold making, molding, finishing. All are handled within our own organization and are coordinated under a single engineering and operating group.

And back of it all is the experience of 25 years and a nationwide reputation for quality production . . . for handling even the toughest jobs well . . . and for making deliveries on time.

If your postwar product calls for molded plastics you can get started today. Our Development Engineers will work with your design and engineering departments to get those ideas of yours on paper . . . to insure a combination of utility and eye-appeal with practical, economical moldability. With that done, your job is ready for mold-making the minute priorities are lifted.

Ask for a CMPC Development Engineer . . . today. There's no obligation.



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Precision Plastic Molding

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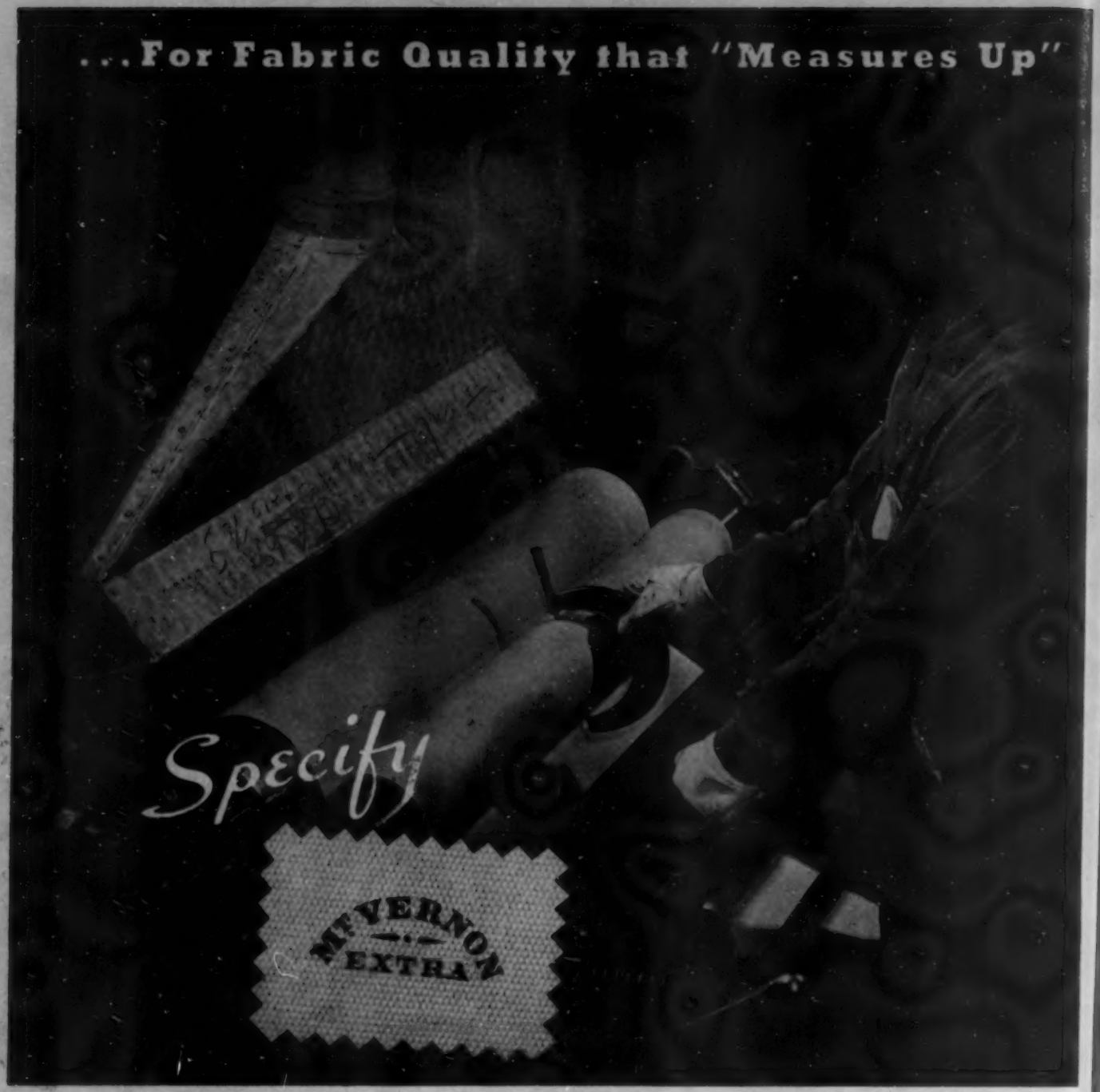

There must be more than just an ordinary physical bond between fabrics and plastic materials in the making of successful laminates. There must be deep fabric penetration of these materials and a fusion of quality with quality if maximum results are to be obtained. That is why laminators specify MT. VERNON Extra. They have learned that fabrics made from carefully selected top grades of cotton and woven to a high degree of uniformity not only step up processing efficiency, but impart added quality to that achieved through their own precise manufacturing procedures. Specify MT. VERNON Extra fabrics.

MT. VERNON WOODBERRY MILLS, INC.

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WE ARE STILL ON THE TARGET

We're still a long way from Victory...we must all stay in there and keep punching ...keep landing on their chins and never under-estimate the effort to be exerted. There is risk in relaxing...the biggest punches are still to be landed. Before Pearl Harbor UNIVERSAL was molding vital war products. Today...and for the duration...the facilities of our plant and experience of our organization are largely devoted to producing war materials. Our Planning Division, however, is interested in cooperating with manufacturers who are thinking in terms of tomorrow's markets. You are invited to consult with them in connection with your postwar production problems.

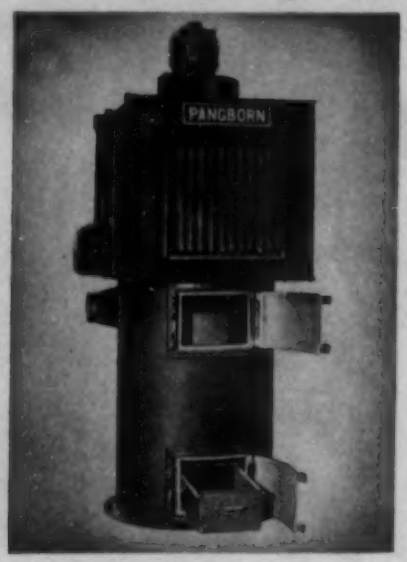
UNIVERSAL PLASTICS CORPORATION

NEW BRUNSWICK • NEW JERSEY

New York Office: New York 17: 12 East 41st Street
Chicago 3: Steel Mill Products Co., Inc., 176 West Adams Street
Philadelphia 6: Paragon Sales Co., Inc., 402 Cherry Street
Detroit 2: June & Company, 719 New Center Building

NEW MACHINERY AND EQUIPMENT

★ THE PANGBORN CORP., HAGERSTOWN, MD., HAS brought out a new industrial type "CK" unit dust collector for small air volume dust control which is designed to provide construction and performance consistent with the requirements of industrial operations. This unit, suitable for all dry dust control applications, is available in 3 sizes with capacities to 1000,



2000 and 3000 cu. ft. of air per minute. No attention is said to be necessary except for the shaking of screens and the removing of dust from a single point at regular intervals. The machine is operated by a magnetic starter with a separate push-button for exhauster motor and a hand switch for the screen-shaking-mechanism motor. An electrical timer is available to operate the shaker motor automatically for a short period each time the exhauster motor is shut down.

★ BECAUSE OF THE TREMENDOUS INCREASE IN THE use of plastics and die castings, Invincible Tool Co., Pittsburgh, Pa., has developed a line of 45 and 90° angle tool attachments which can be held in either a draw-in collet or a drill chuck on any flexible shaft. Burrs or rotary files fit in the threaded end of the attachment or in a drill chuck. These tools come with bronze or needle bearings. Used with a special grease, tools with bronze bearings can attain speeds up to 15,000 r.p.m., while needle bearing tools reach speeds up to 5000 r.p.m. The attachments are available in two sizes, and larger sizes will be manufactured as the demand develops.

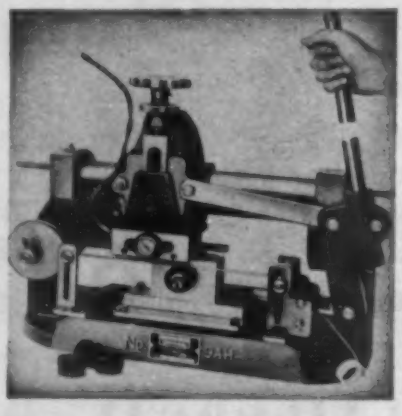
★ A SHELF-TYPE ELECTRIC OVEN, USED TO HEAT various size plastic sheets prior to forming them into gun turrets, enclosures, domes, pilot and bombardier shells and enclosure windows for aircraft, has been designed, built and installed for one of the country's leading plastic fabricators by Koch Industrial Equipment, Evansville, Ind. The oven, which is equipped with an indicating controller, high-limit switch and air flow safety valve, is divided into four compartments, each accommodating two full-sized plastic sheets. A door, fitted with stops to hold it open horizontally, is hinged to the bottom of each section. The possibility of excessive heat loss is eliminated by the use of a foot pedal with which each door can be closed by a light touch of the operator's foot when a compartment is unloaded. The operating temperature range is 200 to 400° F., and any given temperature can be maintained automatically. Undue heat loss is prevented by 4-in. walls, insulated with heavy industrial rockwool batts. In case of air failure the oven can be turned off automatically.

★ THE BRISTOL CO., WATERBURY, CONN., ANnounces a redesigned pyromaster self-balancing potentiometer with a universal wall or flush mounting case considerably deeper than Model 440 M, making possible servicing or replacing of any part without disturbing any other part. It also eliminates considerable external wiring in electric-type controllers by including control relays in the instrument. Other new features are an internal hinged panel with a pen and indicator drive mechanism and a complete new convertible-type air operated control mechanism. A heavy-duty pen-drive motor provides more torque for operating control contacts, and the indicating scale is now a wide horizontal band. A dust-proof phenolic housing encloses the stepping relays and the slide wire in the standard cell-type circuit of manual standardizing. Model 431 retains the basic principle of previous models, providing a self-balancing round-chart recording potentiometer that has no continuously moving mechanical elements, is unaffected by vibration, and needs no lubrication.

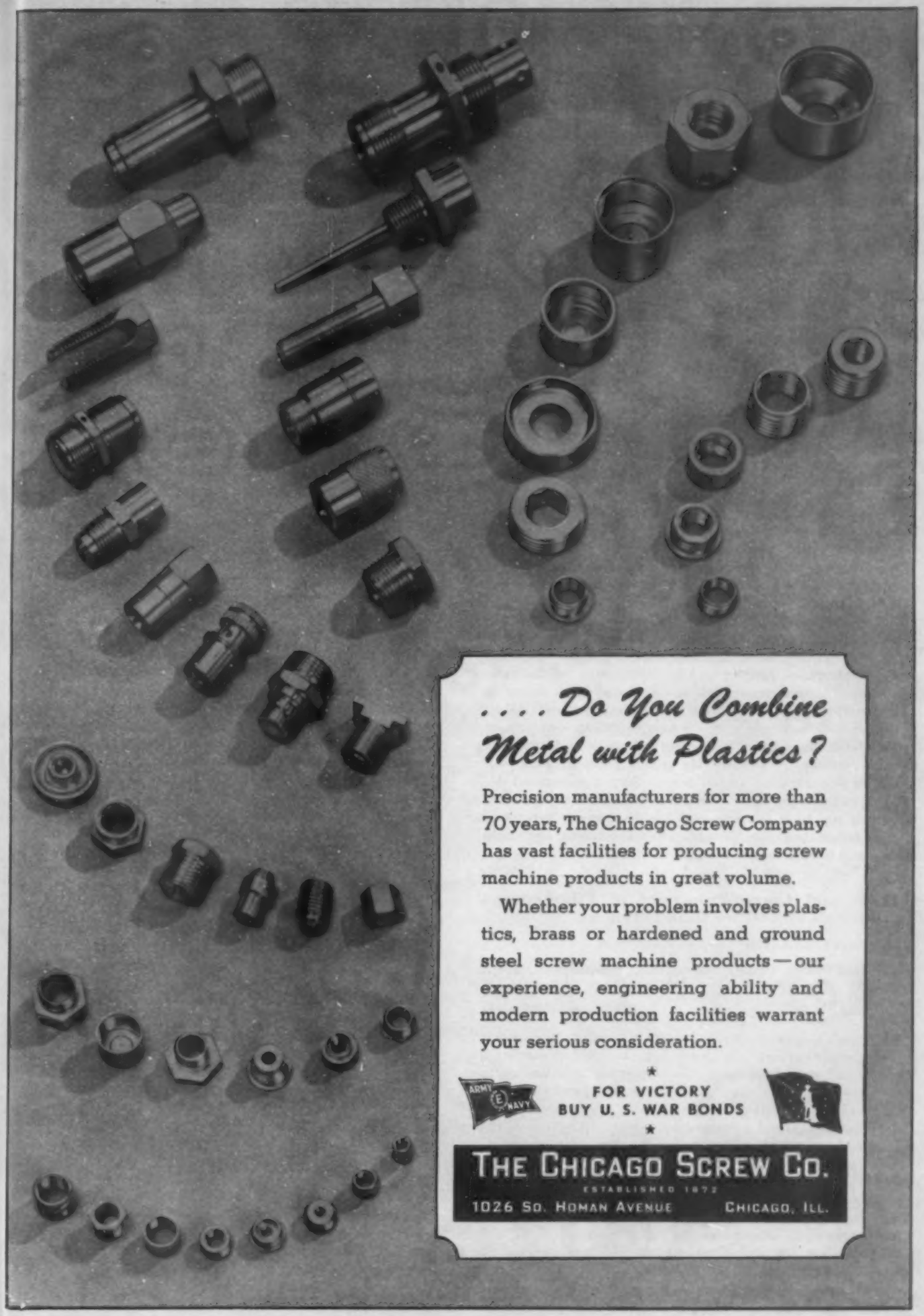
★ THE MILLING TO SIZE AND BEVELING OPERAtions on plastic nameplates have been facilitated at Westinghouse Electric & Mfg. Co., Pittsburgh, Pa., by the use of a milling fixture and a special cutter. In contrast to the old method, employing no fixture and only an ordinary cutter, and handling each individual plate 8 times, a single operation is necessary to complete the milling and beveling. The special cutter has alternate flat and beveled teeth. The fixture is designed to hold 4 nameplates, and the sides of 2 of these are milled to size and beveled while the same operations are being performed on the ends of two other plates. This procedure results in one finished nameplate for each operation.

★ CARBOLOY TIPPED SCRAPER BLADES ARE NOW available in three widths to fit the standard line of hand scrapers manufactured by Anderson Bros. Mfg. Co., Rockford, Ill. In using them it is only necessary to remove the worn steel blade and slip in the new Carboloy tipped blade.

★ A HOT-PRESSURE MACHINE THAT MARKS AND applies pigments of metallic color in the serial identification of machinery with a view to eliminating the slower and more complicated method of engraving and filling, has been placed on the market by the Acromark Corp., Elizabeth, N. J. Users of this



new machine claim an increased speed of at least 20 to 1 over previous methods of production. A roller die rolls the mark into the flat part which is held in position by a special form fixture as the die rolls over it. A specially engraved steel marking die sinks the marking and the color transfer at the same time. Heat is regulated by a thermometer placed on the front of the die holder. This machine is easily adapted to the marking of innumerable instrument and aircraft parts.



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Whether your problem involves plastics, brass or hardened and ground steel screw machine products—our experience, engineering ability and modern production facilities warrant your serious consideration.

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Cellulose and Cellulose Derivatives

Edited by Emil Ott

Interscience Publishers, Inc., New York, 1943

Price $15.00 **1196 pages**

It was to be expected that the publishers of the series of monographs on the chemistry, physics, and technology of high polymeric substances would reserve a special niche for the important cellulose field. Thus, this Volume V on High Polymers comes not as a surprise, but as a further corroboration of the thorough and praiseworthy job which those who are cooperating in this project are doing.

The book has been organized so that it can be used either as a complete text for study from beginning to end or as a reference book with very complete author and subject indexes. The ten chapters deal in turn with the Occurrence of Cellulose, Chemical Nature of Cellulose and Its Derivatives, Structure and Properties of Cellulose Fibers, Carbohydrates Normally Associated with Cellulose in Nature, Lignin and Other Noncarbohydrates, Preparation of Cellulose from Its Natural Sources, Bleaching and Purification, Derivatives, Physical Properties, and Technical Applications. A group of 35 contributors, each one an expert on the particular topic covered, collaborated in the preparation of the text of this book.

The editor states in his preface that the requirements of war have necessitated the increased interest of many technical people in all high polymer fields, especially that of cellulose and cellulose derivatives. A happier note is struck in the conclusion to the book: "Since it seems possible that future development of agricultural products as sources of chemical raw materials will be extensive, it is certainly within reason to expect expansion of these cellulose materials in the lacquer and plastic fields, with the cellulose, esterifying or etherifying groups, plasticizers and solvents all attained from annual crops. Such a widespread development would for the first time give civilization the hope of a perpetual supply of raw materials based on annually renewed sources rather than on exhaustible mineral resources, and would do much to remove the causes of international conflict."

G.M.K.

Elastic and Creep Properties of Filamentous Materials and Other High Polymers

by Herbert Leaderman

Published by The Textile Foundation, Washington, D. C., 1943

Price $2.00 **278 pages, 162 figures**

Experimental work conducted at the Massachusetts Institute of Technology under the sponsorship of The Textile Foundation is described and discussed in this important contribution to our knowledge of the stress-strain-time-temperature-humidity characteristics of certain high polymers. Part I reviews the theoretical background developed by earlier investigators of the elastic and creep properties of materials under constant and alternating loads. An interpretation of the structure of high polymers based on their mechanical behavior under load and during recovery is presented. Part II contains a description of the author's apparatus and experimental procedure and his data on the creep properties of silk, viscose and cellulose acetate rayon, and nylon filaments. A bibliography of 210 references pertinent to this special field is appended. The book will be of interest and value to every one concerned with the structure and properties of plastics and synthetic fibers.

G.M.K.

Electron-Optics

by Paul Hatschek. Translated by Arthur Palme

American Photographic Publishing Co., Boston, Mass., 1944

Price, $3.00 **161 pages**

When the original German edition of this book was prepared, in 1935 and 1936, electron-optics was still in its infancy. The author's primary purpose was to present its basic principles in terms which would be understandable to the uninitiated and explain how these principles had been applied to television apparatus, improved amplifying tubes and a better understanding of northern lights. Because of the similarity between visible and invisible light and invisible electron beams, he has used the more familiar field of optics as a point of departure in his discussion of electronics. The result, expressed in simple, straightforward language, is a stimulating and readable treatment of a difficult subject.

Naturally there is no place in a book of this type for a detailed consideration of the many developments made since its first appearance. However, the translator has added a chapter which briefly surveys the progress of electron-optics in the last half dozen years. Since communication with Germany was shut off before the translation was begun, this information is necessarily restricted to advances in the United States during that period. A short bibliography is appended at the back of the book.

★ "MELMAC MOLDING COMPOUNDS" IS THE TITLE of a new publication by American Cyanamid Co. It summarizes pertinent information regarding melamine-formaldehyde molding compounds sold under the trade-mark Melmac. Data contained in this booklet are subject to continued modification as further research improves molding technique and materials. Melmac, a thermosetting resin, in solution is used for the construction of translucent or opaque laminated sheets, an adhesive in baking enamels and as a plywood bonding agent. In combination with suitable fillers, it is sold as a molding compound. Various type fillers may be used. In this booklet the currently available forms of Melmac—alpha-cellulose filled, mineral filled and chopped-cotton filled, are thoroughly treated. Information is given regarding plasticity, preforming, prewarming, flow, molding, test for cure and finishing operations. Charts, tables and attractive colored photographs add to the interest and help to clarify descriptions.

★ BOOKLET NO. 36, ON THE FASTRAVERSE PRESSES manufactured by Hydraulic Press Mfg. Co., Mount Gilead, Ohio., has just been received. These presses are helping to solve the diversified production problems in plants of some of the largest concerns doing war manufacturing. Pictures throughout the book follow production routine from raw material to finished product. Each type of press and its use are thoroughly described and pictured, and for the convenience of readers there is a list of other booklets published by this company relating to the same subject.

★ R.C.A. VICTOR DIV., RADIO CORPORATION OF America, Camden, N. J., describes its new electronic power generator for industrial high-frequency heating in a booklet just released. The unit and its use are fully detailed, and cross-sectional pictures help to show the inner workings of the machine. Specifications charts, line drawings and excellent photographs add to the interest of the publication.

Organized to handle TOUGH molding jobs

THERE are many plastic molding jobs that practically any molder can handle. But there are others that offer some particular problem such as extra deep drawing, close tolerances, multiplicity of inserts, side cores, fine threading, or where some special technique must be used.

While we handle all types of jobs from the simplest to the most complicated, it is on the really *TOUGH* jobs that we can demonstrate the full value of Imperial Engineering Service.

BULLETIN K-200 — with its helpful comparative table on the characteristics of various compression molded plastics and a brief picture story of how the Imperial molding plant operates—may be of interest to you.

Your request will bring a copy.

The parts shown above are typical specimens of specialized molding work for such organizations as: Teletype Corp., Dixie Cup Co., Bastian Blessing Co., Bell & Howell Co., Simpson Electric Co., Allis-Chalmers Mfg. Co., National Enamelling & Stamping Co., Radio Speakers, Inc., The Imperial Brass Mfg. Co.

And the views of our plant at the right present just a suggestion of the organization that has been built to handle *TOUGH* molding jobs.

If you have molding requirements that call for a broad background of engineering experience and the most modern plant facilities we shall be pleased to work with you—subject of course to present day limitations imposed by our work for the armed forces.

IMPERIAL MOLDED PRODUCTS CORP.
2927 West Harrison St., Chicago 12, Ill.

● Our marked success in handling complicated parts requiring close tolerances, threading and inserts is largely the result of sound "know-how" engineering.

● Our mold makers are specialists in the plastic field and have developed many advances in methods of mold construction. For example, you'll find that threads on Imperial parts are smoother—and harder. This is because threading dies are milled—not turned as is customary.

● Molding equipment includes compression presses of all practical sizes, both of the hand and semi-automatic types. Preforming and measuring machines are utilized for processing molding powder. Infra-red and radio frequency preheating facilities are available.

● The final operations on the molded part are completed in the finishing department. Trimmers take off the fins, and any other necessary operations are performed such as drilling and tapping of holes and inserts, etc. Polishers bring out the special lustre required on certain parts through the use of buffing wheels. Special machines are also utilized for polishing.

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WASHINGTON ROUND-UP

R. L. VAN BOSKIRK, Washington Editor

Phenolic order amended

M-246 (phenolic resins and phenolic resin molding compounds) was amended Feb. 15. The amended order tends to put administration of the phenolic order on practically the same operating basis as the Urea Resin Order M-331 and will supposedly ease administration procedure. The principal changes are:

1. Molders must now file 4 copies of application form WPB 2945 (customer's applications) with WPB in Washington and only one with their supplier. Under the former method, the molder sent 3 copies to WPB and 2 to his supplier. The new method is the same as that employed in urea allocations and will simplify WPB procedure.

2. A "previously authorized" provision enables any applicant to accept delivery of and use up to a total of 2000 lb. a month without authorization, or to use up to this same amount from inventory, for end uses specifically authorized to him by WPB since Oct. 1, 1943. Note that the total amount allowed is 2000 pounds. Some persons seemed to have the mistaken impression that they could use 2000 lb. for each item, which was not the intent of the order. This is a sort of modified small order provision, but it limits end uses to products previously authorized since Oct. 1.

3. There is also a real small order exemption up to an aggregate from all suppliers of 50 lb. of phenolic resin, phenolic molding compound or cast phenolic in any one month which can be used for any purpose. This small order is in addition to allocated quantities. Heretofore no one was eligible to use cast phenolic under the small order exemption and no one could use the small order exemption to get other phenolics if he had an allocation that month. Now everyone, regardless of whether or not he has an allocation the same month, is eligible to take 50 lb. of any phenolic resin product, including cast. Both the "previously authorized" and "small order" provisions are available to individual operating units of the same company.

4. A change in the certification requirements of the order makes it unnecessary for a molder to get a certificate from his customer if the use of the part is obvious to the molder. If the molder does not recognize what the ordered part is to be used for —such things as perhaps parts of plane fixtures or radio sets—he must then have a certificate for his own file.

5. Laminators, specialty manufacturers (brake linings, grinding wheels, etc.), and plywood manufacturers may hereafter apply for their phenolic resin by quarters. Molders and manufacturers of protective coatings will apply on a monthly basis as before.

Every effort should be made to avoid interim allocations. Though interim allocations are not covered by any order, WPB has made them in the past and will continue to take care of urgent cases. However, WPB asks that everybody try his best to avoid interim requests. It is important that all forms WPB 2945 for monthly allocations be in the hands of suppliers and WPB by the 18th of the month.

The protective coating resins built with para phenyl phenol formerly allocated under Order M-254 will henceforth be allocated under this order.

New acetate plastic order

A new order (M 326-B) controlling the shipment, receipt and use of all types of acetate molding powder and acetate scrap molding powder, including butyrate, was issued Feb. 23.

The acetate plastic orders now line up like this: Order M-326 controls all cellulose ester flake, the raw material from which acetate molding powders are made. M-326-A was amended on Feb. 23 so that it now controls only sheets, rods and tubes made from cellulose ester flake. M-326-B, the new order, controls molding powder. It defines acetate molding powder as meaning both cellulose acetate molding powder and cellulose acetate butyrate molding powder, whether produced from cellulose ester flake, from yarn or staple fiber originating from cellulose ester flake, or from trimmings resulting from fabrication of sheeting. Scrap is defined as meaning sprues, runners, nozzle exudations and excess or rejected molded parts of extrusions. Scrap also includes molding powder produced in whole or in part by the reworking of other staple. The intent of the order is to cover every possible kind of acetate scrap that is in existence.

After this order becomes effective on April 1, no supplier shall make any delivery of acetate molding powder or scrap and no molder shall use or make any delivery of acetate molding powder or scrap to any person other than a supplier. The procedure for obtaining authorization by molders is almost identically the same as that for obtaining phenolic, urea or polystyrene by the WPB Form 2945 (formerly 600) method.

Plastics trade groups and numerous individuals in the industry have been asking for a change in M-326-A almost from the time it went into effect. Chief criticism centered around inflated orders, loose control, unequal distribution and the scrap situation. The new order will be helpful to both suppliers and molders in making molding powders available for more uses.

It is believed that the new method of reporting to WPB on form 2945 (formerly 600) will prove more satisfactory than the old form 602 method. In the first place the molder will be dealing more directly with WPB. Under the new method, the molder will state his current situation, how much he wants, his inventory status and current consumption.

It is fairly well known that almost 50 percent of all acetate molding powders can be used for civilian allocations of low essentiality. If this order works as intended, it is believed that this material can be spread out to cover a greater portion of those items than in the past. Allocators will be able to quickly spot inflated requests, oversize inventories and scrap in molders' plants.

Other changes in M-326-A

In addition to deleting the molding powder control from its jurisdiction, Order M-326-A, governing allocations of cellulose ester sheets, sheeting, rods and tubes, was changed to simplify the paper work involved by limiting the control of the order to those materials which are of value to military, industrial or essential civilian production. As a result of the amendment, second-grade and non-standard materials are removed from controls. Anything under 2 ft. square that is a by-product or waste material is now free. Small pieces of this size made "on order" are still under control.

In addition, suppliers are permitted to make "blanket" applications for deliveries against certified orders of aircraft glazing sheet. Officials explained that this end use is always approved as requested and the elimination of order itemization will effect a major simplification. The amendment also permits suppliers to set up "emergency pools" in order to facilitate the delivery of materials against military emergencies. Shipments can be made without specific WPB authorization if the Armed Service certifies in writing that an emergency exists. (*Please turn to next page*)

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And when peace comes, the skillful selection of materials will play an important role in cutting costs and winning postwar markets.

Before substitution of materials or the use of new materials is possible, however, exhaustive and conclusive tests must be made.

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Scheduling in the molding industry

Due to the critical nature of many of the component parts of injection and compression molding machines, it is becoming increasingly necessary that every available machine be utilized to the fullest extent. Since the Armed Services and industry frequently rely upon WPB for information on available machine time, it is suggested that the molders keep the Plastics Section of the Chemicals Bureau currently advised on the status of their available mold time. In this way, WPB will not only be in a position to utilize all facilities to the fullest extent but will be in a better position to assist the molders in absorbing any available molding time. It is suggested that the molders supply the above information to the Plastics Section, Chemicals Bureau, War Production Board, Washington, D. C., and address it specifically to Room 2047, Temporary "S" Building.

Personnel changes in Washington

Major R. T. McBride, plastics specialist in the Technical Division of the Ordnance Department in Washington, has been assigned to Aberdeen Proving Grounds preparatory to a probable assignment overseas in the near future.

Gus Holmgren of the Navy's Plastics Section left Government service on Mar. 1 to join Plastics Engineering Co. of Sheboygan, Wis., where he will be associated with Harry Shaffer, formerly of the Quartermaster Corps and Chrysler, in the development of the thermosetting tubing.

Joseph H. Tatnall, specialist in vulcanized fibre in the Plastics Section of the Chemicals Bureau of WPB, left on Mar. 1 to resume his former duties with National Vulcanized Fibre Co. His duties in WPB have been taken over by Dick Foote.

Ray Martin, who has been a vinyl resins specialist with the Plastics Section of WPB since its inception, has resigned and accepted a position with American Resinous Chemicals Corp.

Of interest to vinyl producers and processors

The following release was sent out by the Government last month: "Bradley Dewey, rubber director, announced that $30,000,000 worth of improvements are to be made in plants producing synthetic rubber and its raw materials during 1944. Highest priorities have been granted to all of this scheduled construction and installation. These projects are in no sense an expansion of the synthetic rubber program. They will simply put into effect certain minor additions and changes designed to bring about more efficient operation of some of the rubber units.

"Three million dollars' worth of the work to be done has been allocated to butadiene-from-alcohol facilities, while $10,000,000 has been distributed to the butadiene-from-petroleum projects. Styrene plants are slated to receive $3,000,000 and copolymer plants will receive $10,000,000. Three million dollars of the 1944 outlay will be allocated to butyl facilities. Butyl is a specialized type of synthetic rubber which is produced from petroleum and tree-resins."

Acetate allocations

First glance at the acetate plastic allocations (meaning cellulose acetate and cellulose acetate butyrate molding powders) as announced by the Chemicals Bureau does not tell all the story that has been going on behind the scenes during the last few months. After all the furor raised about the shortage of phthalate plasticizers and what it would do to acetate plastic allocations, most molders were no doubt agreeably surprised when they discovered that the January, February and March allocations of acetate were approximately the same or better than December, even though substitute plasticizers were necessary.

First, credit is due to WPB and material suppliers for finding a way to meet the emergency. How the various manufacturers scurried around to find substitute plasticizers is a technical and competitive story that cannot be printed here, but certainly a praiseworthy achievement. Some molders were required to pay more for their formulations but, after all, they did get their material and there was surprisingly little complaint concerning the substitute formulations. Some delay was necessary because most material manufacturers needed time to experiment with substitute plasticizers and many molders also wanted to test the new formulations before they placed an order.

The shortage of phthalate plasticizers will doubtless continue for several months due to military need of an entirely different character than that of plastics. Phthalates are needed in ever increasing quantity for insect repellents now used by the military services. These insect repellents will apparently do almost unbelievable things in the way of protecting soldiers from several dangerous diseases spread by insect carriers. Authorities expect that it will take some time to satisfy the demand for this new product and until that demand is met there is likely to be a continuous shortage of phthalate for plasticizer.

Chemical company dividends lead other manufacturing industries

Dividends of $15,000,000 paid by chemical companies in January 1944 lead all other manufacturing industries except food, beverages and tobacco, according to the Department of Commerce. Next in order was electrical machinery with $14,100,000. Both amounts were identical with the dividends paid by these industries in January 1943. The total cash dividends paid by manufacturing industries in January 1944 were $95,500,000 as against $92,100,000 paid in January 1943 or a four percent increase. No significant change in disbursements was recorded for any other major industry group except finance where dividends declined from $73,400,000 in January 1943 to $67,400,000 in January 1944.

Plastics manpower on essential lists

A revised list of essential activities has been released by the War Manpower Commission. This is the first complete list published since December 1942. The list is used by the USES offices in determining the essentiality of the workers' employment. Selective Service Boards use the list in viewing requests for occupational deferment.

The list consists of 35 broad categories. The specific references made to the products, services and facilities are only generally descriptive of the type of activity regarded as essential. Under paragraph 17, "Production of Chemicals and Allied Products," plastics materials are listed. The most authoritative interpretation obtainable is that this includes only plastics raw materials produced in chemical plants.

There are so many lists being used by various local boards and local WMC agencies that no hard and fast rule can be applied. Some months ago there was a critical list published which contained only 6 or 7 items, one of which was fish nets. The chemical industry was not even mentioned on this list. The particular items covered by that list were at that time extremely critical and were given highest priority ratings insofar as manpower was concerned. The new list of essential industries is merely a bringing-up-to-date of all changes that have been made and is not binding on local boards.

In seeking deferment for his men, or in seeking aid from USES, a molder or laminator should use all the lists at his disposal to prove essentiality but above all, he should make every effort to prove that his products are essential to the war effort or to the domestic economy.

Bonding of metals with plastics

The February issue of Technical News Bulletin, published by the National Bureau of Standards, contained the following item: "The printing of postage stamps, currency, war bonds and other Government securities requires the use of large numbers of metal printing plates. The plate ordinarily consists of a reproduction of the engraved master plate, usually obtained by electrolytic means, fastened to a suitable base. The union of face and base is obtained by a combination of soldering and spot welding. Despite the high degree of success attained, the method entails some drawbacks, such as flattening and straightening after warping, etc. As part of a research program in the Division of Metallurgy sponsored by the Bureau of Engraving and Printing, tests are under way to determine the merits of plastic bonding agents to augment or replace soldering-and-welding methods."

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NEWS OF THE INDUSTRY

★ AT A MEETING OF THE BOARD OF DIRECTORS OF the Society of Plastics Engineers in Toledo, Charles C. Henry, Chicago Die Mold Mfg. Co., was elected national president. Other officers elected were: vice-president, William B. Hoey, Plastic Processes, Inc.; secretary-treasurer, John Deer, Sinko Tool and Mfg. Corp. Members of the board of directors are: Robert H. Morehouse, George Clarke, W. C. Goggin, Harry McGowan, John Mickey and Nikolas Rakas.

★ GEORGE H. CLARK, VICE-PRESIDENT OF FORMICA Insulation Co., Cincinnati, Ohio, has been appointed to the important Sub-Committee on Wood and Plastics for Aircraft of the National Advisory Committee for Aeronautics for 1944. Functions of the Sub-Committee include recommendations to the Committee on Aircraft Construction of the National Advisory Committee of problems in the field of wood and plastics as materials for aircraft use, which should be investigated in the Committee's laboratories or by other agencies. The Committee also assists in the formulation and coordination of programs for research and serves as a medium for interchange of information regarding investigations and developments, in progress or proposed, in connection with wood and plastics for aircraft.

★ WE NOTE WITH REGRET THE PASSING OF JESSE Jay Ricks, chairman of the board of Union Carbide and Carbon Corp. Mr. Ricks became chairman in 1941 and had been president of the company from October 1925 to May 1941.

★ ERIK FURHOLMEN, FORMERLY WITH CHICAGO Molded Products Corp., is now chief engineer and works manager of Cincinnati Advertising Products Co., Cincinnati, Ohio.

★ J. C. BROOKS, VICE-PRESIDENT OF MONSANTO Chemical Co., has announced the following promotions within his organization: John H. Clark, general sales manager, has been named director of sales for the Plastics Division. He is succeeded by F. A. Abbiati, formerly assistant general manager of sales. Charles Lichtenberg, sales manager of the molding powder division, has been made assistant general manager of sales for thermoplastic and thermosetting molding materials and synthetic resins. J. R. Turnbull, manager of development and sales promotion, was appointed assistant general manager of sales in charge of sheet materials. C. F. Reeves is now active manager of the Plastics Division's activities in the New York territory. This work is in addition to his duties as branch manager for the division in Washington. A. C. Martinelli, former branch manager of the Plastics Division in the New York City office, has returned to Springfield as sales manager of the thermoplastic molding materials. S. A. Bell will be sales manager and R. C. Evans assistant sales manager of the sheet department specializing in packaging materials at Springfield. Mr. Evans was succeeded in St. Louis by C. L. Richards, formerly manager of the branch sales office in Los Angeles. Mr. Richards was replaced by R. J. Lambert of the Springfield sheet department. K. J. Eklund was named assistant sales manager of the sheet department at Springfield specializing in fabricated articles. Stanley L. King became sales manager of the vinyl resins department. C. J. Jones was promoted to manager of development, and W. H. Richter was put in charge of the sale of molding material in the north New England territory.

★ CONTINENTAL SCREW CO., NEW BEDFORD, MASS., announces the appointment of Raymond C. Franklin to their sales force. During the past 12 years, Mr. Franklin was associated with the sales departments of Corbin Screw Div., Continental Screw Co., and National Screw and Manufacturing Co.

★ MACK MOLDING CO., OF WAYNE, N. J., ANnounces the appointment of W. A. Coombs as their Detroit representative. Mr. Coombs will be located in the New Center Secretarial Building, 6432 Cass Ave., Detroit, Mich.

★ DWIGHT R. MEANS, ASSOCIATED WITH THE COLumbia Chemical Division of Pittsburgh Plate Glass Co. for 21 years, has recently been named assistant to the vice-president. Prior to this appointment Mr. Means was assistant superintendent, research director and technical director.

★ NATIONAL SOCIETY OF PLASTIC TOOLING, REPRESenting 5 major aircraft firms in the eastern United States, has been formed to give added impetus to "plastic tooling," an ingenious war-born development which aids in volume production of warplanes. Officers elected were Delmar Anderson, Curtiss-Wright Corp., president; Harry W. Tompkins, Curtiss-Wright Corp., secretary; and Charles H. Miller, Bell Aircraft Corp., treasurer. The 3 other companies represented are Consolidated-Vultee Aircraft Corp., Grumman Aircraft Engineering Corp. and Glenn L. Martin Co. The aim of the Society as stated by President Anderson, is "to bring together for the first time those practical men who are responsible for the development of 'plastic tooling' as a recognized production process." Aims and intent of the organization may be summarized as follows: 1) facilitation of free exchange of information on developments and applications of plastics; 2) elimination of duplication of effort and expense accompanying individual investigations; 3) furtherance of the development and applications of plastics to industrial tooling and allied applications; 4) establishment of the physical properties of the various available resins to assure proper application of each proven material; 5) standardization of the handling techniques; 6) stimulation of further research by suppliers in production of resins and materials more suited to specific requirements and new applications; 7) coordination of the efforts of suppliers, technicians and ultimate users to the end of simplification of handling processes, techniques and improvement of the base resins; and 8) establishment of a committee to arrange for an unbiased investigation and appraisal of available materials and the making of such findings available to the membership to eliminate work with unsuitable materials.

★ W. S. RICHARDSON, GENERAL MANAGER OF THE chemicals division of the B. F. Goodrich Co., has been elected vice-president of the Hycar Chemical Co. to succeed Raymond W. Albright. Mr. Richardson will continue in his position with the B. F. Goodrich Co.

★ THE CLEVELAND DISTRICT BRANCH OFFICE OF Bakelite Corp. will be located in Room 536, Bulkley Bldg., 1501 Euclid Ave., Cleveland, Ohio.

★ STEWART IREYS, FORMERLY WITH ARMSTRONG Cork Co., has been appointed merchandising director, Merchandising Sales Div., Carborundum Co. T. W. Hall has been transferred from the advertising department of the same company to the position of sales promotion manager of this division.

★ WISHNICK-TUMPEER, INC., NEW YORK CITY, HAS changed its name to Witco Chemical Co., a name based on the company's long-established trademark "Witco."

★ THE CHICAGO SALES OFFICE OF AMERCOAT DIVIsion of American Pipe and Construction Co., Los Angeles, Calif., has moved to Suite 341, McJunkin Bldg., 4554 N. Broadway, Chicago, Ill.

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now are being used successfully in making plastics of all types.

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These qualities are notable — permanence of color, resistance to chemical and physical change, non-reactivity, non-bleeding.

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★ TRUMAN P. HANDY, CHIEF CONSULTANT ON rayon to OPA's Consumer Goods Price Division, has resigned to return to his former position with Celanese Corp. of America, Newark, N. J.

★ RAY ARNDT HAS BEEN APPOINTED MANAGER OF the newly created Door Division of United States Plywood Corp., according to an announcement by Lawrence Ottinger, president. This is part of the corporation's expansion program, directed particularly to the postwar era.

★ ASSETS OF WHEELCO INSTRUMENTS CO., CHICAGO, Ill., have been purchased by Fred A. Hansen and Cary H. Stevenson, vice-presidents of the Lindberg Engineering Co., Chicago, Ill., and several associates. The business of the industrial instruments firm will be continued at the same location under the new corporation, the Wheelco Instruments Co. Officers of the new company are Fred A. Hansen, president; Richard Schoenfeld and Theodore Cohen, vice-presidents; and Cary H. Stevenson, secretary-treasurer. Mr. Schoenfeld will be in charge of sales and production. The new company will expand further into other industrial applications of electronics and supersonics.

★ IDEAL PLASTICS CORP. HAS BECOME THE OFFICIAL molding division of Ideal Novelty and Toy Co., Long Island City, N. Y.

★ PAUL W. LEHMAN, FOR 13 YEARS CHIEF ENGINEER of United States Rubber Co. in Detroit, has resigned to join Giffels & Vallet, Inc., engineers and architects, as consultant on rubber and plastics.

★ THE APPOINTMENT OF ARTHUR LOGOZZO AS A technical service engineer has been announced by MacDermid, Inc., Waterbury, Conn. Mr. Logozzo, recognized as a leading authority on hard chrome plating, brings to this organization a broad knowledge of the metal finishing industry. His talents are available to all New England manufacturers for the installation of plating equipment or for the servicing of existing equipment and plating processes.

★ A SALES OFFICE HAS BEEN ESTABLISHED BY Franklin Plastics Div., Robinson Industries, Inc., Franklin, Pa., at 612 Stephenson Bldg., Detroit, Mich., under the management of Charles F. Hamilton.

★ A SPECIAL ARMY FILM, "WAR DEPARTMENT REport," is available for presentation in all war plants. It may be obtained through the Industrial Services Division, War Department, Bureau of Public Relations, Washington 25, D. C.

Sorry!

★ IT HAS BEEN CALLED TO OUR ATTENTION THAT in the description of the Tenite pellets used in sandblasting equipment which appeared as Item 2 on page 114 of the February issue we should have said that "the surface of piston sides and ring grooves are given a polish *without* abrasion of the metal."

★ WE REGRET THAT ON PAGE 99 OF THE MARCH 1944 issue, in reporting the speech of James B. Neal on "Twenty Years a Molder," delivered before the Conference of the Canadian Section, Society of the Plastics Industry, we inadvertently substituted the name "Mr. Norton" for "Mr. Neal" in the course of the report.

★ IT HAS BEEN CALLED TO OUR ATTENTION THAT William B. Hoey, mentioned in paragraph 2 on page 164 of the February issue, is no longer associated with Bakelite Corp.

★ DUE TO A PRINTING ERROR IN THE ARTICLE ON "Mechanical Properties of Plastics at Normal and Subnormal Temperatures," which appeared in the April 1943 issue, the value for fatigue limit, 60° V-notch, of laminated compressed maple, data sheet number 9, Table VII, page 124, should have been 8000 p.s.i. instead of 3000 p.s.i. (*Please turn to page 180*)

SPEECHES OF THE MONTH

★ "FROM CELLULOSE TO GLAMOROUS PLASTICS" was the subject of a talk delivered by A. F. Caprio, chief of the Patent and Data Div., Celanese Corp. of America, at a meeting of the Montreal Rotary Club. He traced the origin of cellulose plastics from discovery of celluloid by John Wesley Hyatt to the present-day applications of such cellulose plastics as cellulose acetate, cellulose nitrate, cellulose acetate butyrate, ethyl cellulose and others. Mr. Caprio displayed articles of interest to the rigid and flexible packaging trade, the electrical industry, ordnance wrapping for military and postwar shipping, shatterproof transparent and wire-reinforced glazing for airplanes, gliders, factories, greenhouses and solaria, and war materials such as gas-mask parts and lenses, molded and formed parts for high powered fighter planes, blind flying equipment, bayonet grips, fuel gages, grommets, rings and small molded parts of all types.

★ COLD MOLDING MATERIALS AND TECHNIQUES" was the subject of a talk given by John N. Campbell, Garfield Mfg. Co., before the Plastics Engineers Association meeting at the Yale Club, New York City, on Feb. 21. Emphasizing the point that cold molded products, the working rather than the glamour type of plastics, are manufactured only by some 5 companies who have had to develop their own machinery and equipment, Mr. Campbell continued with a description of the 3 groups of cold molding compositions—bituminous, phenolic and refractory. Using samples of products in each class as concrete illustrations, he discussed the composition, molding technique, properties and applications of all 3 types, stressing the impact strength, heat resistance and dielectric properties of cold molded products, and high rate of production from single-cavity molds.

Victor Rosenlund, Jr., of Reed-Prentice Corp., spoke on "Injection Molding Machines," describing in detail the specific parts of the modern machine, explaining how machines are listed and classified, and discussing the advantages of the injection process for various types of molding. D. Maxwell, The Waterbury Companies, Inc., talked briefly on the necessity for plastics salesmen to be well informed, and the importance of correct engineering of plastics products if postwar markets are to be maintained, quoting figures on the relative weights and current prices of plastics and light metals.

★ PLASTICS AND SYNTHETICS WILL BE USED IN carpets of the future according to A. G. Ashcroft, product engineer of Alexander Smith & Sons Carpet Co. In his talk before the annual convention of the New York Carpet Cleaners' Assn., representing the manufacturers, Mr. Ashcroft emphasized the fact that for at least two years after the war, the carpet industry's full capacities will be utilized in replenishing depleted wholesale and retail inventories. He outlined a few developments of recent years which will be given active play in the laboratories of the industry: 1) new types of water-insoluble sizing materials; 2) synthetic fibers in addition to the special rayon types which have been manufactured; 3) extruded yarns for backing materials; 4) high wet strength kraft yarns; 5) insect and mold resistant application to pile and backing yarns; 6) new texture effects made possible by synthetics; and 7) stain and spot resistance. He also cited the fact that chemistry now is on the ascendance in the fabricating business.

Morton Wild, Simon Manges & Son, representing the distributor, offered points of criticism to manufacturers, cleaners and dealers, and Miss Rajean M. Codish, U. S. Testing Co., speaking for the consumer, outlined the important rug demands of the housewives. Keynote speaker of the meeting was Paul C. Trimble of "The National Cleaner and Dyer," and summation speaker, Sidney Moore, Carman & Co. Paul B. Williams, President of the Association, was chairman of the convention.

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Photographs — Courtesy Eastman Kodak Company

* *Moulded for Saunders Venom Extractor Co., Tarpon Springs, Fla.*

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Fatigue of urea adhesives

(*Continued from page 122*) across the glue line from center moments determined from equations (6) and (7). The first set of panels yielded somewhat higher results than the second, but overall averages and limits were as follows:

Shear: average 190, low 120, high 230 p.s.i.
Tension: average 815, low 530, high 1015 p.s.i.
Wood failure; average 65, low 45, high 100 percent.

Alternating stresses—Table III summarizes the tests in which glue-line failures occurred under alternating stresses at amplitudes of 5/16, 1/4, 3/16, 1/8 and 1/16 inch. Tests in which wood failed in fatigue are not included. Furthermore, the results are for clamped or semi-clamped specimens and for specimens in which failure was complete, except for those which ran to 5,000,000 cycles without failure. The same results are shown graphically on logarithmic paper in Fig. 10.

Maximum amplitude, 5/16 in., induced maximum tensile stresses perpendicular to the glue line were approximately two-thirds of those found in the modulus of rupture tests. At minimum amplitude, 1/16 in., induced tensile stresses were approximately one-seventh of those found in the modulus of rupture tests. Shear stresses were quite low compared with the static shear tests; the maximum at 5/16-in. amplitude was 5 percent of the static shear. Failures were primarily tension perpendicular to the glue line and were the kind that would be found in most actual structures. At 1/8-in. amplitude, one specimen ran to better than 5,000,000 cycles. The others failed at approximately 150,000 to 1,000,000 cycles. At 1/16-in. amplitude, all specimens ran to better than 5,000,000 cycles without any signs of failure.

When tested in static shear, the unbroken vibrated specimens yielded results which actually averaged a little higher than the static controls. This indicated that at least there was no loss in strength. In those vibration specimens which failed during test, lower percentages of wood failure were found than in the modulus of rupture controls. No definite trend in numbers of cycles and stress could be discerned.

In Fig. 10 the numbers of cycles of stress reversal are plotted against amplitude, shear stress and maximum tension perpendicular to the glue line. Curves are drawn for the arithmetical averages and for the approximate limits of the scatter bands in the graphs of cycles versus amplitude and cycles versus tension perpendicular to the glue line. Scatter for the shear results is not plotted, inasmuch as shear was a minor factor in causing failure. The curves of amplitude and maximum tension versus cycles to failure flatten to practically zero slope well above the 5,770,000 cycle point.

Conclusions

Conclusions must be drawn with some reservations from these tests, inasmuch as the scatter in the results renders generalizations somewhat difficult. It appears, however, that

TABLE III.—ALTERNATING BEND TESTS OF MAPLE VENEERS BONDED WITH UREA RESIN "UFORMITE CB-551"

Specimen No.	*Amplitude*	*Shear stress*	*Tensile stress*	*Number of cycles*	*Wood failure*	*Static shear*	
						Stress	*Wood failure*
	in.	*p.s.i.*	*p.s.i.*		*percent*	*p.s.i.*	*percent*
A3-Ea	5/16	135	510	8,800	5		
A4-Bb		135	515	500	50		
A4-Ea		135	520	1,100	60		
A5-Ba		135	520	7,700	85		
A5-Ea		115	440	4,400	40		
A6-Ea		140	540	1,100	60		
AA1-Aa		175	660	2,700	70		
Averages		140	530	3,600	55		
A3-Rc	1/4	115	440	500	40		
A4-Rc		125	470	500	60		
A6-Rc		115	440	6,600	60		
AA1-Ba		135	510	2,200	15		
AA3-Ba		115	510	11,000	20		
Averages		120	475	4,200	40		
A3-Db	3/16	80	310	4,400	10		
A4-Db		95	360	49,500	40		
A5-Db		85	330	40,700	50		
AA1-Ca		90	350	600	0		
AA3-Ca		145	420	7,400	5		
Averages		100	350	20,500	30		
A3-Cb	1/8	40	130	570,000	80		
A4-Cb		50	190	220,000	15		
A6-Cb		50	190	5,780,000	85		
AA2-Da		65	240	688,000	30		
AA3-Da		65	280	1,040,000	5		
AA4-Da		50	230	149,000	5		
Averages		55	210	1,408,000	40		
AA4-Ea	1/16	27	120	5,770,000	None	1733	95
AA5-Da		27	120	5,770,000	None	1462	85
AA5-Ea		27	120	5,770,000	None	1862	90
AA6-Da		26	115	5,770,000	None	1347	45
AA6-Ea		26	115	5,770,000	None	1712	65
Averages		27	120	5,770,000	None	1603	75

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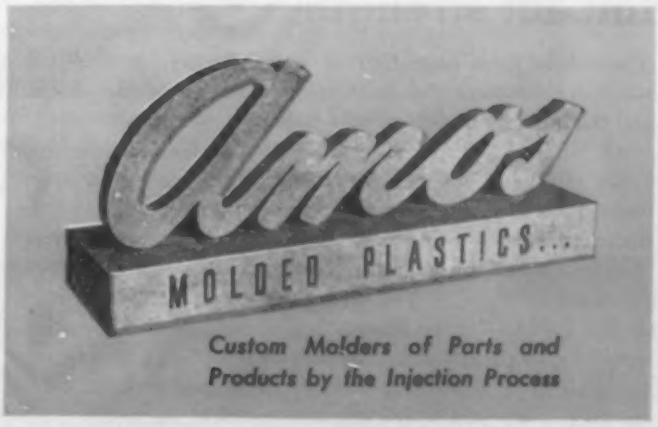


the following may be said with some assurance with respect to stresses at room temperatures, based upon tests made at room temperature upon specimens at approximately 9 percent moisture content:

1. A joint having the general proportions of those tested and subjected to vibrations is as apt to fail in fatigue in the wood as in rupture in the glue line.

2. Inasmuch as the sections tested were quite heavy and spans were short, so that higher shear was induced in the glue lines than would customarily be found, it seems safe to say that failures in glue lines of this type will occur primarily because of tension perpendicular to the glue line (and the grain of the wood) rather than by shear in the glue line.

3. If maximum tensile stresses perpendicular to the glue lines of these adhesives are kept below 120 p.s.i., there should be no failures. As a matter of fact, extrapolation of the observed curves indicates that it is highly probable that stresses can be 150–160 p.s.i., that is, 20 percent of the "modulus of rupture," or static ultimate stresses. If stresses reach 200 p.s.i., failure may be expected to occur at 5,000,000 cycles or less, and as the stresses go still higher, the number of cycles to failure becomes rapidly smaller, with highly variable results. The "fatigue limit," if that term may be employed here, appears to be 20 percent of the ultimate.

Application of these results depends upon the ability to determine stresses in vibrating structures by analysis or test. Wherever members cross each other, bending moments are apt to set up tensile stresses perpendicular to the glue line and the grain of the wood. Such stresses may be uniformly distributed, or may vary from maximum to minimum approximately as in the tests here described. In such instances, the dimensions of the overlapping parts should be large enough to keep the tensile stresses from exceeding 20 percent of the tensile strength of the wood perpendicular to the grain. For species such as maple and birch, alternating tensile stresses of 125 to 150 p.s.i. may be employed; for other species such as spruce or mahogany, the stresses will be less.

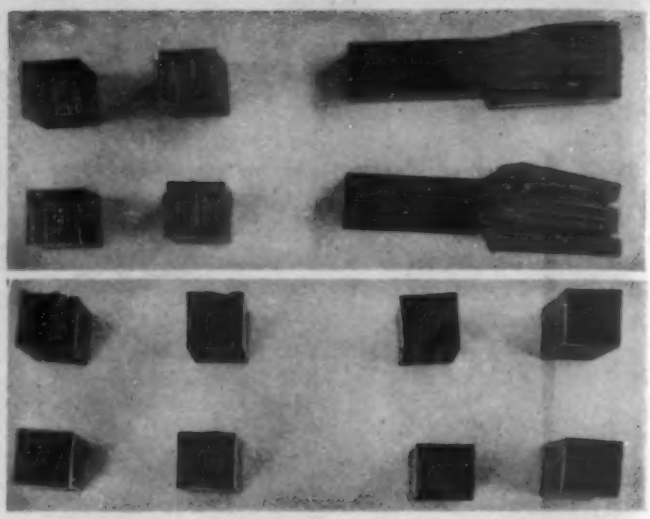
Acknowledgments

Acknowledgments are due particularly to John Barry, research assistant, who carried out the experimental work, and to Professor W. M. Murray, Department of Mechanical Engineering, Massachusetts Institute of Technology, who was instrumental in the design of the testing apparatus. The laboratory staff of the Resinous Products and Chemical Co. made the test material.

Impact strength

(*Continued from page 125*) at approximately 340° F., at which temperature the reinforcing material began to char and the impact strength dropped sharply.

All laminated materials were better under facewise than under edgewise impact. Examination of the tested specimens shows that edgewise specimens break sharply, the fractured surface being relatively smooth, whereas in facewise specimens, the fractured surface is jagged. This is illustrated in Fig. 2. The edgewise specimens of the glass-cotton material broke sharply while the facewise specimens failed by delamination and flexure without being broken into two pieces. In this case, part of the difference in the absorbed energy is undoubtedly due to the degree of interlaminar shear.



2—Typical fractures of impact specimens. Top illustration shows samples of cotton-glass laminate; bottom photograph shows Nema grade "XX" paper laminate

It is possible that the same phenomenon occurs to a certain degree in all laminates and may account for the difference in impact strength.

Conclusions

Phenol-formaldehyde and other thermosetting resins with suitable reinforcing materials can have single-blow impact strengths equal to aluminum or magnesium. The reinforcing agents producing the highest impact strength of those tested are glass and cotton cords.

M-52 trench mortar fuze

(*Continued from page 114*) manually from the press to the No. 1 station of the unloading table. In Fig. 31 the operator at this station is unscrewing the $^1/_4$-in. pin. This operator also disassembles a $1^1/_8$-in. and $^5/_{16}$-in. threaded plug with an electric unscrewing device at the same time that the plugs which mold the safety pin holes are withdrawn by means of air-operated fingers controlled by a foot pedal. All of the threaded pins and plugs that are removed at this station are transferred by a chute to the wedge assembly girls on the opposite side of the table (Fig. 31). This same operator then moves the cavities along a track to the girl at the No. 2 station. This operator removes the $1^1/_2$-in. and $1^3/_{16}$-in. plugs with another electric unscrewing device. With a separate unit of the same kind she unscrews the $^9/_{16}$-in. pin and removes the molded part from the wedge. This operator then reassembles the $^9/_{16}$-in. pin which she has previously removed, and passes the empty cavity along to Stations 3 and 4 where the loose pins and plugs are completely reassembled. The cavities then are moved along a track to a steam-heated hot plate where they are kept at their elevated temperature until needed by the molder for the next shot.

A total of 5 operators are used in the molding operation. One molder handles the preheating of the preforms, and loading and unloading of the mold. Four operators disassemble and assemble the wedges.

The next step in the production of these fuzes comprises

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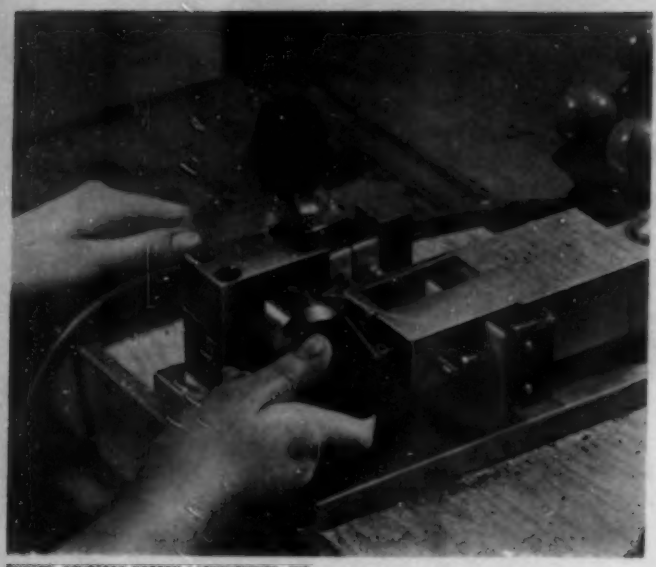

36

PHOTOS, COURTESY NORTON LABORATORIES, INC.

the check-gaging operation. As is customary, Norton Laboratories has set up a gaging operation which checks the condition of the mold and eliminates the possibility of a large amount of scrap because of the failure of some part of the mold.

The two finishing operations shown in Figs. 33 and 35 are about all that are necessary to prepare the fuze parts for final inspection. Figure 35 shows the drilling of the 0.320 to 0.340-in. hole which not only opens the passage between the firing pin and the detonator but also serves to remove the gate. Figure 33 shows a rather unique setup for reaming flash from the slider-pin hole. In this operation, the fuze body is set up on a sliding jig and moves forward so that the rotating reaming tool enters the hole and clears it of flash.

After all flash has been removed and the holes drilled, the fuze bodies are sent along to the gaging operations, a general over-all view of which is shown in Fig. 34. In this setup a conveyor belt, moving down the center of the table, permits a fast and simple transfer of the parts from one gaging station to the next. Electrical gages equipped with micro-switches have been installed for many of these operations. These gages are similar to the ones in use at the Chicago Molded Products Corp., and can be set to indicate variations in dimensions as low as 0.0001 inch. Figure 36 shows a setup of one of these highly accurate micro-switch gages in which the operator is checking the depth from the axis of the 0.200-in. hole and, at the same time, checking the 0.703- to 0.717-in. dimension. The micro-switches are mounted at various points on the gaging fixture while the indicating bulbs are in the background. Figure 37 shows an inspector checking the over-all height. The gage used in this operation is of the swivel type which brushes across the top of the fuze body.

There are many additional dimensions whose variations must be carefully checked (Fig. 34) with other and equally intricate gages before the molded parts are considered satisfactory and sent to the assembly plant.

The preceding descriptions of the production setup at the plants of five of the larger producers of M-52 fuzes have followed the development of this part from the manufacture of the preforms to the final packing of the finished product. It is understood, of course, that these molders do not account for the entire production of plastic M-52 trench mortar fuzes. Numerous other molders throughout the country also are engaged in this work. The methods employed by the largest molder of these fuzes, the General Electric Co., have been previously described in an article entitled, "Producing trench mortar shell fuzes," which appeared in the January 1943 issue of MODERN PLASTICS.

Credits—Material: Bakelite, Durez, Makalot, Resinox and Textolite.

36—***Highly accurate micro-switch gages are used at Norton Laboratories to check the depth from the axis of the 0.200-in. hole and to gage the 0.703 to 0.717-in. dimensions.*

37

37—***An operator at this same plant checks the over-all height with a swivel-type gage which brushes across the top of the trench mortar fuze body***

Hearing more for less

(*Continued from page 83*) case and the inside of the unit is sandblasted and coated. The cases are shipped by the molder without any buffing, polishing or special finishing having been performed on the plastic parts beyond those already mentioned. Intermittently, a fixture has been used by the molder for the placing of inserts in the mold. However, experience has shown that girl operators can spot the 4 inserts approximately as fast by hand. Danger of the workers being burned during this insertion is slight since the temperature of the mold is not high as in a compression mold.

The earphone tubes or studs are molded of methacrylate in 4 different lengths. This variation in size is designed to compensate for physical variations in the individuals wearing the hearing aid. The tubes are molded in sets of 4 studs—one of each size—in a cycle slightly better than 30 seconds. Because of the shape of this part, it was necessary to design the mold so that the parting line is through the central plane in the long dimension of the earphone tube. Since this line is objectionable on the bevel surface, it is sanded smooth. The rest of the parting line including the gate is cleaned by hand with a knife. The sprues and runners can be reused.

To assemble the methacrylate tube to one of the rubber tips which fits into the ear, the end of the plastic tube is moistened and then slipped inside the rubber tip (Fig. 2). After the earphone tube has been pressed on the earphone, the rubber tip is inserted in the ear with a slight twisting movement. In this case, a good fit is a snug fit; a loose fit will cause whistles

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and squeals. However, the earphone assembly should not be so tight as to be painful.

A good hearing aid, however, is only half the battle. The manufacturer of this instrument emphasizes the fact that two factors are involved in the use of this instrument—and the hearing aid is but one. The other factor is the wearer. Emphasis is placed upon the fact that this instrument can be of real help only if the user has the patience to keep wearing it until he learns how to use it correctly. Hearing impairment is seldom a simple matter of uniform loss in hearing sensitivity to all sounds such as occurs when the volume control of a radio is turned to a low level. Instead, the hearing loss varies with the individuals. Some lose much or all of their sensitivity to high tones while suffering little or no loss to lows. Due to this type of deficiency a person may be able to hear the low tones of a cello, but miss some of the higher tones of a violin. This same individual may hear only the vowels in a word and lose the consonants which have a higher pitch. Other people face the same problem in reverse. In almost all cases, a hard-of-hearing person suffers not only from loss of hearing but from unbalanced hearing as well.

To overcome this unbalance, the hearing device is equipped with a 4-position tone control designed to assist in the right combination of sounds to fit the individual hearing problem. Position 1 boasts low, medium and high tones; Position 2 gives an added emphasis to high tones and cuts the low; Position 3 emphasizes medium tones without undue emphasis on high or low; Position 4 gives extra emphasis to low tones and reduces the high notes. For satisfactory results in the use of this hearing device, experiment with the tone control is necessary. And after the most effective tone has been selected, the volume control can be adjusted from low position.

One of the great advantages of this instrument is its compactness. So that the amplifier unit can be worn wherever it is most convenient, the case is equipped with a clip which may be attached to either the front or back. Although the hearing aid may be almost entirely concealed beneath the wearer's clothing, the simplest and most efficient method is to fasten the amplifier unit to the outside of a shirt or dress, and to carry the batteries in a pocket or attached to the waist with a belt. It has been found that if the amplifier is worn under heavy clothing there will be some loss of efficiency because clothing shuts out sound. Also, if outside sound is muffled the wearer may hear some noise from clothing rubbing on the case. Emphasis is placed by the manufacturer upon the fact that a hard-of-hearing person is more conspicuous without an aid than with one.

Credits—Material: case, Styron; tubes, Lucite. Molded by Elmer E. Mills Corp. for Zenith Radio Corp.

Tolerances for laminates

(*Continued from page 95*) should be such as to allow for shrinkage, as otherwise special mandrels will be necessary, adding to cost and lengthening the time of delivery.

Standard tubing will show some eccentricity variations between inside and outside diameter. These variations will be greater in fabric-base tubing than in paper-base stock. Molded tubing will be less concentric than rolled tubing and, as a general rule, the heavier the wall, the greater the eccentricity. Where close concentricity is required, tubing can be ordered with correct outside diameter and smaller inside diameter to allow for a boring operation; or the correct inside diameter can be ordered with outside diameter large enough to allow for turning to size.

On very close tolerances for concentricity, where machine spindles are worn, it may be necessary to machine both inside and outside. On very small diameters, it is often advisable to use rods and drill holes concentric. If it is necessary to give limits for concentricity, total indicator reading or double the allowable runout should be specified. On standard production, with careful operators and constant checking, it is possible to make small parts on automatic machines with indicator reading as low as 5 to 6 points. Since this involves extra costs, such close tolerances should be avoided if possible.

Impractical tolerances are often specified on parts made from vulcanized fiber and phenolic resin impregnated vulcanized fiber. These materials are subject to shrinkage often extending over a period of years, depending on temperature, humidity and weather conditions. It is possible to fabricate parts made from this material to very close tolerances, but it cannot be guaranteed that these tolerances will be maintained after the parts reach the consumer or after they have been in storage in dry or moist locations. Parts fabricated from vulcanized fiber often show a noticeable change in dimensions on dry and wet days.

Another point that is often overlooked concerns the tolerances on square or rectangular tubing. Round tubing and rod can be ground to very close limits in centerless grinders, but grinding square or rectangular tubing is often difficult and expensive. The sides are inclined to close in slightly so that while the corner-to-corner dimension may be within limits, a plug gage will not enter because of the slightly concaved sides. Unless the wall is thin enough to spring out easily in assembling, allowance should be made for this dishing in order

TABLE IV.—PERMISSIBLE VARIATIONS IN CUT LENGTHS OF TUBES

Length, in.	*Permissible variations, plus or minus, in. 3/16 to 2 in., outside diameter*	*Over 2 to 4 in., outside diameter*	*Over 4 in., outside diameter*
3 and under	0.010	0.010	0.030
Over 3 to 6, incl.	0.010	0.015	0.030
Over 6 to 12, incl.	0.015	0.020	0.030
Over 12 to 48, incl.	0.030	0.030	0.050

TABLE V.—PERMISSIBLE VARIATIONS IN DIAMETER OF TUBES

Nominal inside and outside diameters, in.	*Permissible variations, plus or minus, in. Inside diameter*	*Outside diameter*
1/8 to 33/32, incl.	0.003	0.005
3/4 to 1 15/16, incl.	0.004	0.005
2 to 4, incl.	0.008	0.008
4 1/8 to 12 1/8 (rolled only), incl.	0.010	0.025

TABLE VI.—PERMISSIBLE VARIATIONS IN CUT LENGTHS OF MOLDED RODS

Length, in.	*Permissible variations, plus or minus, in. 1/8 to 1 15/16 in., incl., in diameter*	*2 to 4 in., incl., in diameter*
3 and under	0.010	0.010
Over 3 to 6, incl.	0.010	0.015
Over 6 to 12, incl.	0.015	0.020
Over 12	0.030	0.030

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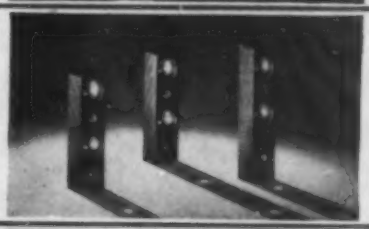
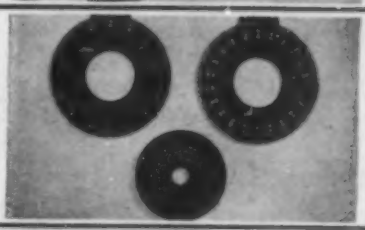
MECHANICAL LAMICOID		Strength and lightness make it superior to wood or metal for many uses. Easily punched, sheared, sawed or machined into simple or complex shapes.	Applications: Gears, pinions, spacers, bobbins, bearings, pulleys, rollers, baffle plates, cones, gaskets, valve discs, etc.
GRAPHIC LAMICOID		Permanently bonded protection for drawings or printed material. Available in rigid or flexible opaque and translucent forms.	Applications: Dials, wiring diagrams, nameplates and fluorescent dials, panels, signs, etc.
ENGRAVING LAMICOID		A sandwich-type opaque sheet, with colored surface and contrasting colored core. Easily pantograph-engraved or sand blasted. No filling necessary, permanence assured.	Applications: Nameplates, dials, signs, therapeutic equipment panels, etc., particularly where only a few of each kind are required.
TRANSLUCENT LAMICOID		Flexible laminated sheet in a variety of colors. Does not soften under heat, has a low expansion coefficient and will not support combustion. Ideal for "rear" illumination.	Applications: Industrial and decorative uses, including dials, signs, lighting fixtures, elevator signal panels, buttonlite signals, hospital call signals, etc.

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Send for data sheets showing properties and characteristics of LAMICOID, and suggestions for its use in your own plant or industry. Service engineers are also available, without obligation, for consultation on the suitability of LAMICOID for present or future uses.

TABLE VII.—PERMISSIBLE VARIATIONS IN DIAMETER OF MOLDED RODS

Nominal diameter, in.	*Permissible variation, plus or minus, in.*
1/8 to 1 15/16, incl.	0.005
2 to 4, incl.	0.008

TABLE VIII.—TOLERANCE LIMITS FOR PHENOLIC LAMINATED SHEETS

Diameter of hole	*Drilling*	*Punching,[a] 1/16 stock*	*Punching,[a] 3/32 stock*
Up to 1/4 in.	−002 + 003	−003 + 003	−004 + 004
1/4 to 1/2 in.	−002 + 003	−004 + 004	−005 + 005
1/2 to 1 in.	−002 + 005	−005 + 005	−007 + 007
1 to 2 in.	−010 + 010	−006 + 006	−008 + 008

[a] When making dies allow 0.003 in. per in. on hole center distances for shrinkage where it will be necessary to heat stock for punching.

to avoid trouble with inspectors and in assembling operations. On very thin walls the sides may even bulge out slightly near the center of each side.

There are so many conditions that have to be considered, that it is difficult for anyone even to outline what may be the "ultimate" close tolerances that can be guaranteed. With extreme care used in making the tools and machining the stock, and with close inspections and supervision, the limits shown for sheet material in Table VIII are about as close as the plastic nature of phenolic laminates will permit and these tolerances can only be secured by increasing production costs. In shearing and sawing, tolerances are:

Shearing all grades: ±1/16 in. on length and width, up to 5 in.

Sawing all grades: ±0.005 in. on length and width, up to 5 in.

Sawing all grades: ±0.010 in. on length and width, 5 to 10 in.

Sawing all grades: ±1/64 in. on length and width, 10 to 24 in.

It should be pointed out that it is fairly easy to guarantee 80 to 90 percent of an order within reasonably close limits with standard manufacturing operations. It is the remaining 10 to 20 percent which causes the headaches, added costs and delays. Considering the scarcity of skilled help and the general necessity of prompt deliveries under wartime conditions, the whole subject of tolerances on laminated plastics is of the greatest importance. Careful consideration should be given each dimension so that the maximum safe tolerance is allowed.

Pattern plates

(*Continued from page 84*) drag boards—are used instead of a single match pattern. The top half of the pattern is mounted on one board; the bottom half on the other. The two halves of the mold are obtained from the two boards.

From the assembly of the model to the making of the mold, pattern plates upon which the patterns are mounted to form the completed match plate, must meet a variety of rigid requirements. From the standpoint of the pattern shop in which the match plates are made, the plates must be accurate both as to flatness and uniformity of caliper, and must be machineable, easily available and reasonable in price. The maximum allowable warpage or variation in caliper of the average plate is customarily set at from 0.002 to a maximum of 0.005 inch. Drilling, tapping and, at times, slight routing or end milling are the mac ining operations normally performed on these plates.

Foundry requirements for the completed match plates are stability, light weight, thickness, satisfactory surface and long life. In this instance the term "stability" denotes not only a lack of warpage in the material but also sufficient strength so that the plate is free from deflection during the first unbalanced filling and squeezing of the mold; i.e., when half the mold is entirely empty and the other half packed with sand. Weight is an important consideration due to the fact that the plate is handled by hand. In a high-production foundry this means that the match plates are lifted countless times each day. Since the misalignment of the two halves of the mold when it is assembled on the guide pins is in direct proportion to the thickness of the match plate, considerable attention is given to thinness when material is being selected for this application.

There are two reasons for emphasis being placed upon the surface of match plates: the sand must not stick to the plate, and, during the squeezing of the sand the surface must not be so smooth or so highly polished as to allow the sand to "ram-off" or "ram-away" from the juncture line of the pattern and the pattern plate. If such a "ram-off" occurs, a fin with a fillet is formed which prevents the forming of a clean casting.

Long life in a match plate is influenced both by surface hardness and by the general ability of the plate to "take it." Where surface hardness is insufficient, there is a tendency of the flask to wear down into the plate rather rapidly. This condition results in an offset between the edge of the flask and the sand mold. Consequently, when the two halves of the flask or molding box are assembled, there is a void between the sections of the mold which creates a heavy fin.

To meet these various conditions, a wide range of materials have been employed in pattern plates. Early mahogany plates generally were 7/8 to 1 in. in thickness. After careful machining of the board to achieve uniform caliper and flatness, special end strips were customarily attached by a standard mortice and tenon joint and adhesives in order to prevent subsequent warpage. As plywood became available it was employed for these plates, being used in sheets of the thickness specified for mahogany. When either of these materials is employed for match plates, wood patterns are preferred. These mahogany and plywood plates were soon followed by pattern plates of steel, generally 3/16 in. thick; aluminum, usually 3/8 in. thick; and magnesium, generally 5/16 in. thick. While steel and magnesium plates are customarily cut from rolled stock, aluminum plates can be made from rolled stock or they can be cast. Match plates also have been made from resin-bonded plywood cores covered with thin metal surface sheets. This material usually is used in 3/8-in. thicknesses. The newcomer to the field is laminated lignin plastics which is generally used in the 1/2-in. thickness. While metal patterns are used with metal pattern plates, both metal and wood patterns have proved satisfactory when employed on plates made from laminated lignin plastic or from material with a resin-bonded plywood core with thin metal surface sheets.

In some instances where many identical patterns are required and where the mold cost is low, compression-molded plastic patterns have been used. Just prior to the outbreak of the war, considerable interest was evidenced in patterns of cast resins. In recent years, the so-called pressure-cast match plate has been used to a considerable extent. This is

Coal is the great storehouse of plastics

PHENOLIC RESINS

Their relation to coal:

Phenol, cresol, xylenol are coal tar compounds.

PHENOL-FURFURAL RESINS

Their relation to coal:

Phenol, cresol, xylenol are coal tar compounds.

VINYL RESINS

Their relation to coal:

Calcium carbide, from coke and limestone, yields acetylene, basis for vinyl resins.

STYRENE RESINS

Their relation to coal:

Styrene is made from benzene, recovered from coke oven light oils.

MELAMINE RESINS

Their relation to coal:

Melamine is produced from cyanamid, made from coke.

UREA RESINS

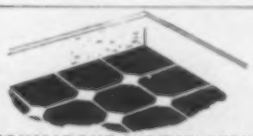
Their relation to coal:

Water gas, made from coke, furnishes the raw material for urea and formaldehyde.

ANILINE-FORMALDEHYDE RESINS

Their relation to coal:

Aniline is made from benzene, recovered from coke oven light oils.



COUMARONE-INDENE RESINS

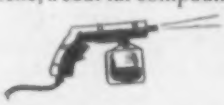
Their relation to coal:

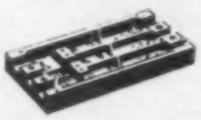
Coumarone-indene is derived from coal tar solvent naphtha.

ALKYD RESINS

Their relation to coal:

Phthalic anhydride for alkyd resins is derived from naphthalene, a coal tar compound.





COLD-MOLDING COMPOUNDS

Their relation to coal:

The binder used in many cold-molding compounds is coal tar pitch.

SYNTHETIC RUBBER

Its relation to coal:

The synthetic rubber ingredient, styrene, is derived from benzene, recovered from coke oven light oils.

NYLON

Its relation to coal:

Nylon is made from chemicals derived from benzene (recovered from coke oven light oil) and phenol (from coal tar).

Plastics statistics are now veiled in cloaks of military secrecy, but the last available figures show coal tar synthetic resins far outweighing non-coal tar resins.

The sketches on this page show many of the principal resins and the coal derivatives which are employed in them. Koppers mines coal, produces large quantities of these basic materials for many manufacturers of plastic materials, and has developed and built many of the plants in which they are recovered.—Koppers Company and Affiliates, Pittsburgh, Pa.

KOPPERS

The Industry That Serves All Industry

NOTE: Many of these Koppers products are on allocation

an aluminum casting in which the pattern and the plate are made integrally, and it offers the advantage of requiring only one master pattern for a multiplicity of such duplicates as are to be mounted on the plate.

In a comparison of the performance records of the various types of materials which have been used for match plates, the laminated lignin plastic plates stand up very well. In the thickness normally used for plates of laminated lignin plastic, this type plate weighs about the same as a mahogany or magnesium board, and is approximately two-thirds the weight of an aluminum pattern plate. Although the plastic plate is slightly thicker than either an aluminum or magnesium plate, it is considerably thinner than the wood or mahogany plate. Experience would seem to show that this plate's increased thickness as compared to the metal pattern plates is not too detrimental.

The laminated lignin plates can be readily milled, sawed, drilled, tapped, turned, filed, sanded and otherwise machined. In general, metal working tools should be used for this work. In drilling, experience has shown that the material should be backed to obtain a clean hole without a break-through crater. To achieve the desired accuracy for these plastic plates, close inspection is necessary. So far as stability in the foundry is concerned, the lignin plates have demonstrated sufficient flexural strength to resist deflection under normal conditions. Being highly resistant to shock and having a dense uniform structure, these plates can be satisfactorily employed with vibrators. The material's average strength values come within the following range: compressive strength, 25,000 to 35,000 p.s.i.; flexural strength, 15,000 to 21,000 p.s.i.; tensile strength, 9000 to 14,000 pounds per square inch.

Because of the material's good water resistance, these plastic plates will not warp, crack or swell when exposed to high humidity conditions or when in contact with wet sand. In addition to having a moisture absorption of less than 1 percent for a 24-hr. immersion in water at room temperature, the laminated lignin plastic is highly resistant to oils, greases and dilute acids.

As far as surface is concerned, these plastic plates probably rank first—with sand-cast aluminum coming second. Since the typical satin-finish or high polished surface of this material will cause "ram-offs," a special surface has been developed for this application. This surface is obtained by pressing the board between sandblasted press pans or cauls. The lightly raised surface that results from this treatment has been found satisfactory in actual practice.

While laminated lignin plastic plates are probably not so longlived as either aluminum or magnesium plates, instances have been reported where 8000 molds have been made from a plate. In a few cases as many as 12,000 molds have been made from one plate. As far as cost is concerned, the following listing[1] gives the normal prices for a typical 12 × 18-in. flask-size plate:

3/8-in. aluminum	$8.00 to $9.00
5/16-in. magnesium	$7.00 to $8.00
1/2-in. laminated lignin plastic	$5.25
3/8-in. resin-bonded plywood core with thin metal surface sheets	$3.00
7/8-in. plywood	$1.00 to $2.00

While the materials having a resin-bonded core with thin metal surface sheeting and magnesium are no longer available, aluminum is available on priority. The laminated lignin plastic is available without priority. However, since practically all present foundry work is on a priority sufficiently high to obtain aluminum plates, the use of the plastics plates by certain foundries might be interpreted to indicate a preference for this material rather than enforced use due to the fact that alternate materials are not obtainable.

[1] These figures have been supplied by Marathon Chemical Co.

Plywood tubing

(*Continued from page 90*) the roll and a few additional winds at the end serve to protect the tubing from injurious agents both without and within. The result is a hard, waterproof cylinder which is said to possess the resilience of natural wood plus lightness and excellent resistance to fatigue, impact, pressure and tension.

The specified length of such a tube determines the width of the veneer and paper strips. Thickness depends on the number of convolutions wound on the mandrel and the thickness of the veneer. A tube which is to have a 1/4-in. wall will therefore require 16 full winds of a 1/64-in. veneer. Thus far the company has produced tubes ranging from 1 to 24 in. in inside diameter.

A number of factors are involved in the strength of a given cylinder: the assembly of wood grain, the kind of wood used, the type of resin in the impregnated paper, the wall thickness of the tube and the veneer thickness. Up to the present time only hard woods have been employed—mahogany, poplar, birch, maple, pecan, hickory and sycamore. However, with adequate treatment, soft woods may also prove practical. Decorative effects may be obtained by using an exotic wood for the outer layer. Today, phenol-formaldehyde is considered the best all-round bonding agent. However, urea resin serves equally well for certain purposes and, after the war, cold-setting bonding agents will be available.

One possible future use for this tubing, which was suggested by a Hawaiian sugar planter, is as a piping in overhead irrigation systems. The only point in question as to the tubing's adaptability for this work was whether plywood pipes could be easily assembled or tapped on the field. The answer is yes. Light weight is an outstanding characteristic of the tubing, and sections which have been threaded before they were supplied to the customer can easily be joined by means of threaded plastic couplings. Thermosetting or cold-setting resin poured around these joints secures a tight, quick-hardening seal. Not only is this plastic-plywood combination waterproof and leakproof, but it contains nothing that can corrode. The chemical properties of the plastic bonding agent repel termites, rodents and fungi. Similar pipe lines could be employed for factory intercommunication systems and for the conveyance of natural gas. In sections of the country where the soil has a high mineral content or is extremely acid, such pipes could be laid without fear of electrolytic or chemical action occuring.

According to a recent consumer survey,* some 900,000 families plan to buy or build a home during the first 6 months after peace is declared. New constructional features which promise to reduce maintenance costs will have a strong appeal to these potential homeowners. The strength and impermeability of the plywood tubes should, therefore, recommend their use for drain pipes and rain gutters as well as for interior piping.

A number of vistas are opened by the possibility of turning out pipes with decorative exteriors. The need for concealing

* Compiled by the U. S. Chamber of Commerce.

TOUGH IS RIGHT!

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Yes sirree! Plastics can really get tough when they have to! For convincing proof, examine the illustrations at the right which show some of the rigorous tests which this helmet liner is required to pass.

There is also an interesting production story back of this "tough baby." Naturally, fast and economical production were essential. So a "preform" was made from impregnated canvas, ingeniously die-cut and stapled to the approximate shape of the mold cavity. After molding the edges are sheared and ground smooth, and eleven holes are simultaneously punched in one operation.

We at MOLDED PRODUCTS are proud of our share in thus contributing to the protection of our fighting men. The design and production "know-how" which helped to make this helmet liner are also available to help solve your molding problems. Send us specifications for quotation, or ask one of our engineers to consult with you. MOLDED PRODUCTS COMPANY, 4533 W. Harrison St., Chicago (24), Ill.

PLASTICS DIVISION
MOLDED PRODUCTS

THE BALL TEST—This machine drops an eight pound steel ball onto the plastic helmet liner from a height of 30 inches. Each piece must withstand this test *twice* without fracturing before it is passed on to the next test.

THE FLEXING TEST—Rigid yet flexible! There must be no cracking or chipping when the edges of this plastic liner are forced together, as pictured above. It springs back into perfect shape.

THE STEAM TEST—To survive the standard de-lousing procedure, this plastic liner must stand up to a steam pressure of 17 lbs. and a heat of 254° F. without chipping, pealing, losing its shape, etc.

interior pipe might be eliminated through the use of tubes made from cabinet woods as a covering for such fixtures. This type of cylinder might also be employed for supporting pillars, verandah rails, cornices and balustrades. Apart from its decorative value, this resin-bonded plywood when used in humid or tropical climates might add years to the life of the structures in which they are employed.

A recurrent headache in large department stores is the need for enclosing or covering the pillars which separate various display and sales sections. One solution might be to make up a decorative plywood cylinder to the required dimensions, cut it in half and then assemble the halves around the offending columns. The time and labor for installation would be negligible, the end result added attractiveness for the floor layout. In alteration jobs—as, for instance, the conversion of an apartment house basement to a small shop or restaurant—these patterned tubes offer new ways of turning functional excrescences into objects of beauty.

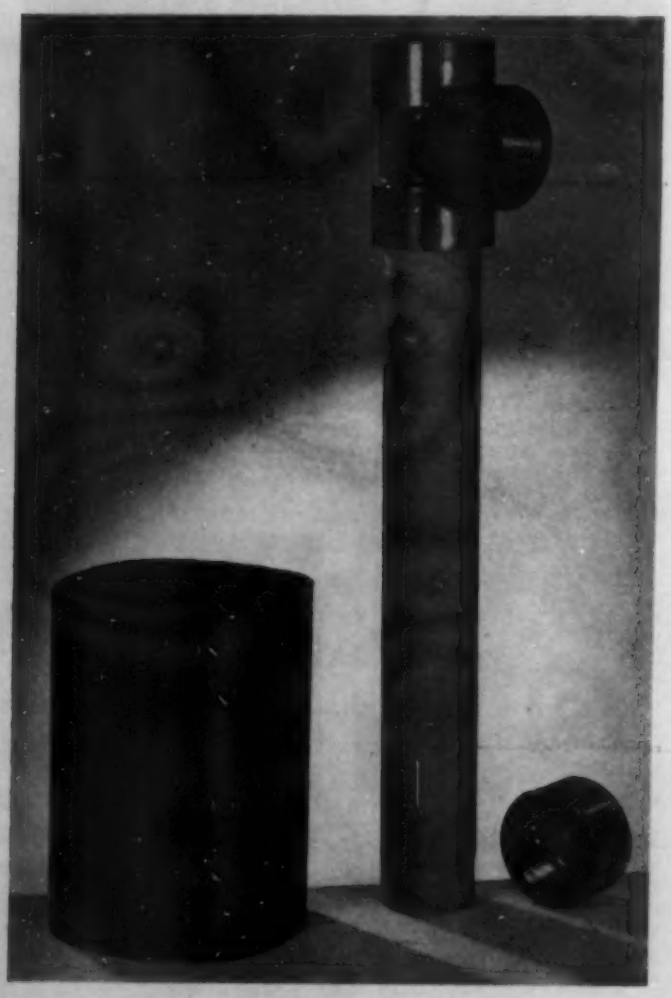
Telescoping supports of all kinds, where lightness, strength and flexibility are important, appear to be another practical outlet. A camera house is intrigued by the adaptation of the tubing to portable projection screen stands. Radio antenna masts which are easily transportable and just as easily set in place are additional possibilities. Seagoing applications include strong, lightweight masts for our merchant marine, car handles, water breakers and storage tanks for gas and oil.

In the packaging field, both the utilitarian and decorative forms have their functions. Oil companies are seriously considering plywood containers for shipping, since they are said to be far easier to handle than the type formerly employed and to take an extraordinary amount of rough usage. Furthermore, their insensitivity to certain materials seems to make them especially suitable for the transportation and storage of explosives and chemicals. The merchandising value of decorative plywood containers for cosmetics and a variety of offerings opens up further possibilities.

The low-priced airplane and helicopter market would seem to offer extensive postwar opportunities for plywood and, therefore, for this new convolute-wound tubing. During the last few years an increasing airmindedness has broadened the limits of this market. The need for speed has produced a group of business men who habitually rely upon air travel. When one adds to this group the returning aviators and plane mechanics, the aircraft plant workers and a plane-minded younger generation, the potentialities grow more impressive. The solution for this market is a craft that will not only be fairly low-priced at the start but will also be comparatively inexpensive to operate. Many designers believe that the new tubing possesses the properties needed for such a lightweight plane because of its fatigue strength, resilience and impact resistance. The finished plane should weigh at least 25 percent less than the average small metal craft.

Credits—Material: phenol-formaldehyde resin, General Electric Co., Plastics Divisions. Tubing manufactured by Wm. L. Marshall, Ltd.

Plywood piping assembled with threaded saran couplings can be used in overhead irrigation and factory intercommunication systems or for conducting natural gas



Realities or reveries?

(*Continued from page 81*) telling her to have it dry cleaned; folded between her doeskin gloves is a slip advising her to wash them with mild soap and in lukewarm water; her chrome-plated skillet announces via a pasted-on label that it should not be scoured with steel wool. Similarly, her acetate measuring cup should wear a tag warning her not to set it on a hot stove.

At the jewelry counter, our housewife fared better. Plastic jewelry, which can be manufactured from scrap, was plentiful, popular and everywhere fast moving. Although jewelry is only a small fraction of the dime store trade, running as high as 4 percent in a good jewelry neighborhood, it forms a large percentage of the business of many specialty shops and hence is an important and profitable plastic outlet. Buyers for two syndicates which supply chain stores estimated that 75–80 percent of all of their jewelry and *all* of their earrings are of plastic material.

In jewelry, the preference is for those items which best show the inherent qualities of plastic—color and light weight. Most of the jewelry is colored acetate, though in 1943 acrylic came in strongly because of the reject material from airplane and other war plants. Best sellers of all have been the plastic earrings in pastel colors and flower designs. Large pastel brooches in pansy or rose designs, sold either separately or in sets with the earrings, are also much in demand. Bracelets, too, in transparent or opaque acetate, are fast moving. In the absence of metal, incidentally, some strange substitutes have been tried; and a rather curious advantage of plastics mentioned by one manager was that ants didn't get into it! He had taken a loss, he said, on his dyed macaroni chokers, which were all eaten by ants.

Less popular was the gold and silver jewelry made of plated acetate, although the industry exercised ingenuity and intelli-

Will PLASTICS Work Miracles?

It sometimes seems that way, but plastics are not expected to replace older materials in all industry. Instead, these synthetic products will be used where their specific properties give them an advantage in the final product.

The possibilities of increased sales from the correct use of plastics cannot be overlooked, but these possibilities will be realized only through a knowledge of the properties of each material—its limitations as well as its advantages—its physical makeup and record in service.

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gence in the designing of their gold plated pieces. The buyer for the largest syndicate, however, thinks there will be a large field for gold and silver plated on acetate after the war, pointing out that plastic does not absorb plate as did the old white lead, and that the jewelry, therefore, lasts a lifetime, besides being much lighter in weight than metal. It is precisely this last advantage which probably prejudices the housewife against it. As the object of plated ware is to imitate real gold and silver, the gold plated plastic does not feel to her like good jewelry because it has no weight. Besides, she does not expect her chain store jewelry to last a lifetime. Her point would seem to be, really, that nothing imitates metal so well as metal, which brings us back to a basic rule of designing, i.e., that plastics should not be used to imitate other materials, but should bring out its own inherent qualities. The plastic goods most popular with the consumer have always been the colored ones.

There was universal complaint about plastic jewelry which did not have metal clasps. Our housewife, always practical, asks for metal fastenings on her plastic jewelry after trying plastic earrings with clips that break and plastic brooches whose pins fall out. The effort to make it entirely of plastic has ruined many an article. Plastics combine well with other materials and should be used in combinations.

In the field of toys, Joe's visions of airplanes, balloons and beetle cars actually come to life, and his wife, too, admires the new playthings. The plastic toys of the past two years have been well made and designed, but buyers and consumers have been somewhat prejudiced by the exorbitant prices some of them command. For instance, a small jeep which is widely sold in the chain stores as well as in more expensive stores retails at 35 cents, whereas its metal counterpart costs about 15 cents. The buyer for one large syndicate says that the public is willing to pay more for plastic toys at present because there are no metal ones, but after the war the price must be competitive, or plastic airplanes and ships will be pushed off the market. The present scarcity of material for toys is such that this cynic keeps framed on his desk a *New Yorker* cartoon of two boys talking over their Christmas haul and saying, "What did you get that wasn't cardboard?" as a reminder to wishful purchasers that they need not ask for plastics or metal. The only plastic toys which his syndicate is buying are the jeep already mentioned, a small airplane, and three small ships—a warship, carrier and transport, each retailing for 10 cents—a variegated rattle ball, and doll furniture and dishes when he can get them. There are limited quantities of almost all of these things. Before the war the doll dishes were a stable best seller, as was doll cutlery. Another best selling toy in the chain stores is some charming period doll furniture—which, incidentally, keeps two of the molders' 8-oz. presses going 3 shifts throughout 12 months of the year.

As in many other plastic items, color is the leading selling point in plastic toys, and chain and department stores report a big Christmas business in brightly colored plastic doll dishes. The game sets (checkers, chess, dominoes, and games with plastic counters) in jewel-like colors are more popular than the old bone ones ever were.

In the manufacture of infants' toys, plastics are universally conceded to be *the* best material because of their color, light weight and nonflammability. Color again seems to be the most important consideration and selling point for two reasons: the colored toy attracts the infant eye, and when chewed its color does not come off as does that of painted toys. For this reason plastic blocks have largely replaced wooden blocks—or had, before the war. Because the colors favored for plastic infants' toys are clear pastels, pink and blue, with some yellows and reds, there are almost no plastic infants' toys on the market today.

Plastic infants' toys have been well made and well designed. In 1940 and 1941, beautiful, simple designs appeared in deep blue rattles with animals' heads, big carriage beads in primary red and yellow, concentric circles and triangles to extricate from each other, and all the panorama of the Land of Oz come to life. After the war, *provided the price is competitive and the standard of good construction maintained*, infants' toys should be an almost exclusive field for plastics.

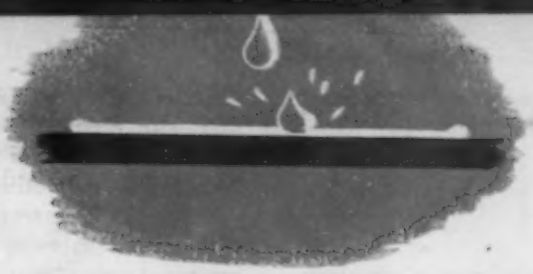
According to those who serve her, the housewife's reception of plastic novelties and hair goods has been mixed. Individual chain store managers complain that plastic combs bend and break, but the syndicate buyers, who are better informed, explain that, while some may today be molded of unsuitable material, the prewar combs of vinyl, methacrylate, the acetates and polystyrene were very satisfactory. Methacrylate picture frames have been well received but the chain stores find them too expensive. When this plastic can be had cheaply enough, it is very popular, and dresser sets (brush, comb and mirror) retailing for about $3 sold well in the chain stores before the war and are now called "a terrific seller." Table and floral ornaments and vases of acrylic are good sellers. The material lends itself particularly well to modern designing and the molders and fabricators have, fortunately, avoided the pitfalls of trying to imitate old English cut crystal and clung to modern design.

Plastic closet accessories, when they were available, were most acceptable. The American closet is, or was before the war, fast outstripping the American bathroom as the most amazing 20th Century discovery. The variety of changes rung by Hollywood and a clever closeteer on a mere closet (which should now certainly be dignified by the name of "Salon Closet") is practically infinite, including hat cones, hat trees, hat boxes, shoe trees and cabinets, shoe cases, blanket boxes, pillow boxes and many another which the housewife is unable to identify.

Buttons have marched to an unassailable position on the plastic front. The only trouble with them is that, like all foot soldiers and yeomen, there are not enough of them, and managers are always putting them into reserve. On the other hand, plastic zippers, according to salespeople, have not to date competed with metal.

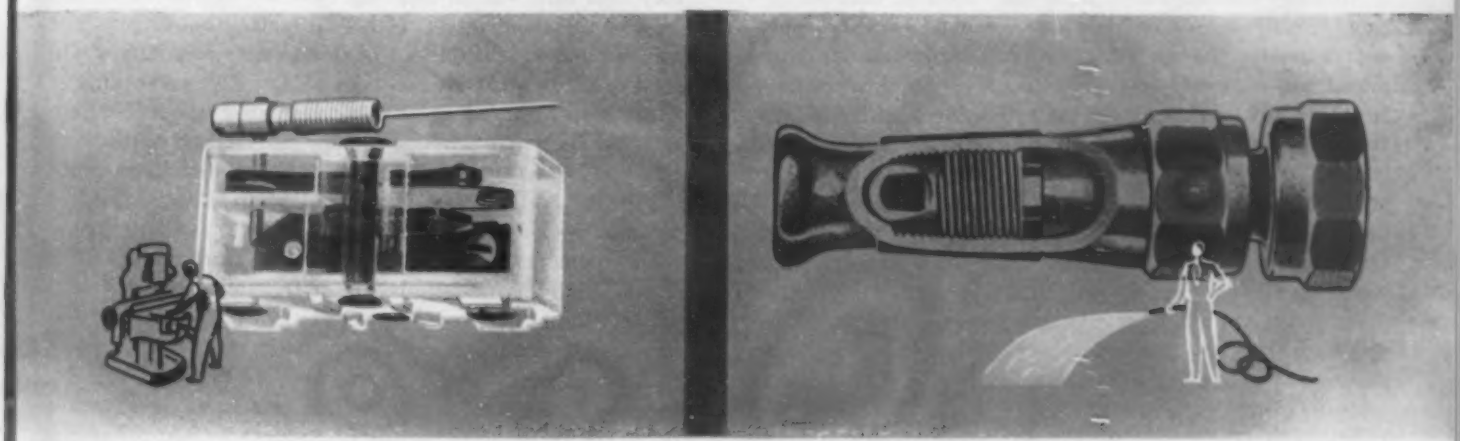
Lipstick and cosmetic containers of plastic have been generally popular, and in spite of war limitations on the size of the cases, are more attractive than ever before. In the cosmetics world, in fact, as in the world of babies' toys, plastic material seems to be a natural. The delicate colors and the variety of effects, the lightness and above all the texture, make plastic the material *par excellence*.

The molder who followed our housewife from counter to counter would find lots to think about, and if he made a conscientious effort to see through her eyes (and pay out of her purse) his conclusions might be somewhat as follows. There is an unlimited field for plastics in the small goods, either alone or in combination with other materials. Although there have been failures to date, they have been due to 1) unsuitable use of the material, or 2) uncompetitive prices or 3) poor design or 4) failure to tell the purchaser how to care for the product. Such failures occur in all manufactures, and are in no way due to defects in the plastic materials themselves. Too often fabricators and molders, instead of sticking to applications which make use of the unique qualities of plastics, have fallen into the error of copying products which



What plastic has highest resistance to water?

Among all plastics—Styron (Dow Polystyrene) stands out for stability to water. Absorption after 24 hours test is 0.00



Selection of plastic materials for a specific job usually calls for careful "balancing" of properties. After weighing all requirements, you will likely choose the one plastic that most nearly meets *all* of your needs.

In this process of selection, you will find Styron (Dow Polystyrene) an extremely helpful material. It is well balanced—capable of doing many jobs.

We call your attention to Styron's outstanding resistance to water because this single property is important in so many applications. In electrical products, precision moldings, and many movable parts, stability to water is essential. Styron's water absorption after 24 hours immersion at 25° C. is 0.00. Even after prolonged periods, it is not affected by humid conditions or contact with water—in moldability, color bleaching or dimensional stability.

Complete property "balance" is obtained through Styron's excellent insulating properties, low specific gravity, acid resistance and broad color range. These factors give Styron a place of importance in every plastic discussion.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago
St. Louis • Houston • San Francisco • Los Angeles • Seattle

Dow announces the opening of a Detroit office to serve this important industrial area

DOW PLASTICS INCLUDE

STYRON . . for fabricators producing moldings, extrusions, rod, sheet.
ETHOCEL . . for fabricators producing moldings, extrusions, coatings; also as Ethocel Sheeting.
SARAN . . . for fabricators producing moldings, extrusions, pipe, tubing, sheet; also as Saran Film.

Write for the New Dow Booklet "A Practical Approach to Plastics."

STYRON

(DOW POLYSTYRENE)

DOW

CHEMICALS PLASTICS MAGNESIUM

INDISPENSABLE TO INDUSTRY AND VICTORY

are best made of other materials. The test should be, not "Can it be made almost as well in plastic?" but, "Is it *better* in plastic?"

Small wares and the molder

What of the postwar future of this vast array of consumer items? What is its future in relation to the potential volume of tonnage and dollars certain to come from the production of durable articles such as washing machine agitators, vacuum cleaner housings, refrigerator cabinets, radio cabinets, office furniture and the like? Figures compiled by one of the largest molders in this field show that in 1941 approximately 576,000 lb. of material and 9500 press hours went into the molding of 285,000 radio cabinets while 12,250 washing machine agitators consumed 33,600 lb. of material and took 1200 press hours. How will these compare with his tonnage on some popular premium item, if he should elect to mold one after the war?

Although comprehensive figures are lacking, that production of small wares chewed up a tremendous quantity of prewar materials, no one will question. Manufacturers introduced new materials—one after another—and most of them found a ready acceptance and use. The introduction of polystyrenes promised even greater production, lighter weight and lowered cost and, until allocation for war use practically stopped its use for civilian items, delivered as per promise.

As a pleasant reminder of the tonnage, dollar volume and man hours consumed in production of "small stuff," consider a couple of items turned out by an eastern injection molder. With spasmodic production over a 2-year period his presses ejected just 15,900,000 pieces best described as a "small auto accessory" which retailed at 5 to 10 cents in auto accessory and dime stores. This obviously popular item consumed only $2^1/_2$ lb. of polystyrene per 1000 produced—about 45,000 lb. of material—but even with multiple-cavity molds it was a nice basic overhead job. The same molder enjoyed a profitable run on a novel flashlight which the user wears on his wrist. Injection molded in one operation were two sets of cases complete with switches. Two hundred thousand of these a month was the production schedule and the total had passed 2,000,000 before war cooled off the presses. Produced of acetate in a choice of five colors, this handy little gadget weighed just 2 oz. exclusive of battery and retailed at 98 cents. It's simple figuring to see that a quarter of a million pounds of material went into this novelty. That the public didn't get enough is indicated by the plaintive appeal of the manufacturer for "at least 30,000 more a month."

Midwest molders, long big-time in the novelty field, have turned out near-astronomical quantities of items distributed through retail, advertising and premium channels. Consider a popular "repel-propel" penknife, one of many stock items of a midwest firm. This knife was on the market for 15 years in a full range of colors, and more than 4,000,000 were in use before high carbon blade steel shortage shut off production. (As a note of cheer—they'll be back on retail counters soon, but no production can yet be allocated for premium distribution, through which many an owner got his). Chess sets, key tags, soap dispensers, flashlight cases, match cases, cocktail stirrers, cosmetic novelties, picture frames, etc., comprised the bulk of this molder's production before the war—and it's a safe bet his orders for postwar delivery of such articles add up to a fancy set of figures which constitute a longtime job promise to his large personnel.

That amazing toy bugle produced by another midwest molder for a musical instrument company is a splendid example of the eye appeal and product improvement only possible with plastics. Within 90 days after young America first beheld them, over 1,000,000 had been sold at a quarter—far outselling competitive ten cent items.

Tops for dripless servers (honey, syrup, cream), in a variety of functional shapes and sizes and with color appeal, of course, consumed tons of acetate and kept another Midwest molder busy filling orders which, on a couple of items alone, totaled a million-and-a-half in one year.

Such examples are far from rare. A large Providence molder ran one press 24 hours a day for 8 months on a novelty costume jewelry item—an acetate pin which, in script style, spelled out the wearer's name. So many thousands of gross of these fad pins were produced that it would seem likely that every Mary, Marge and Susan in America tagged herself in the color of her choice. No—individually they didn't weigh much, but the aggregate probably consumed more material than many a fair sized industrial application.

Up in Leominster, Mass., the "Comb Capital of the World," they still turn out an amazing quantity of combs, though most of them end up as "G.I." Barrettes, bobby pins and hair ornaments still roll out of this pioneer plastics town in great quantity and wide profusion along with a great range of "hush-hush" war items. Yankee ingenuity has enabled the mass production specialists of New England to continue to fill a goodly percentage of their orders for civilian items which fall in the necessity class by utilizing scrap materials and developing new production methods.

One molder who calls his business a "syndicate house" had developed all-plastic barrettes more than a year before metal was shut off to him and thus was able to supply his end-users much longer than some of his competitors. With his plant running about 70 percent on war work, he has still been able to protect his longtime syndicate customers by avoiding the temptation of orders from new customers who cast before him the bait marked "name your own price." As a consequence he no doubt has maintained customer loyalty and on V-Day will be ready to enjoy the lasting fruits of his very ethical policies. Export business was a fast-growing phase of this molder's volume before the war. When world markets again are open he plans an even more intensive cultivation of this profitable field.

Another large injection molder of plastic jewelry, hair ornaments and the like has many items in the blueprint stage, has maintained his customer loyalty, and says that when materials, molds and additional presses are available he will be ready to serve a hungry buying public with a "greatly expanded line."

A prominent small wares molder who has always made his own tools has converted 40 percent of his plant space to production of large steel parts for ships and tanks. Thus he has been able to hold together his staff of highly skilled toolmakers who also find it possible to devote a little time to the more conventional phases of the business. Here again is a splendid example of ingenuity saving the day; in addition to performing an essential war work and under the handicap of an employee roster reduced from 600 to 300, this molder has seen his costume jewelry production become even larger than in any prewar year. How? By using sheet and other scrap, stamping out rather than molding, and re-training his help to perform a dozen hand operations. Unprecedented volume is the result and while there may be no great pride in the quality, it is profitable business.

Of the postwar world this old-timer says, "We know we can't do business after the war like we do today. We must really merchandise and sell. This trend is already developing,

How to Put Your Grinders "in the Pink"

Here's what the new *blue flash* trademark on Bay State grinding wheels means—

Fast. Only Bay State offers fractional grades—three degrees of hardness in a single grade. No more trouble due to a wheel being *a trifle* too hard or *a trifle* too soft. You can match the job requirements *exactly* — to get FASTER production.

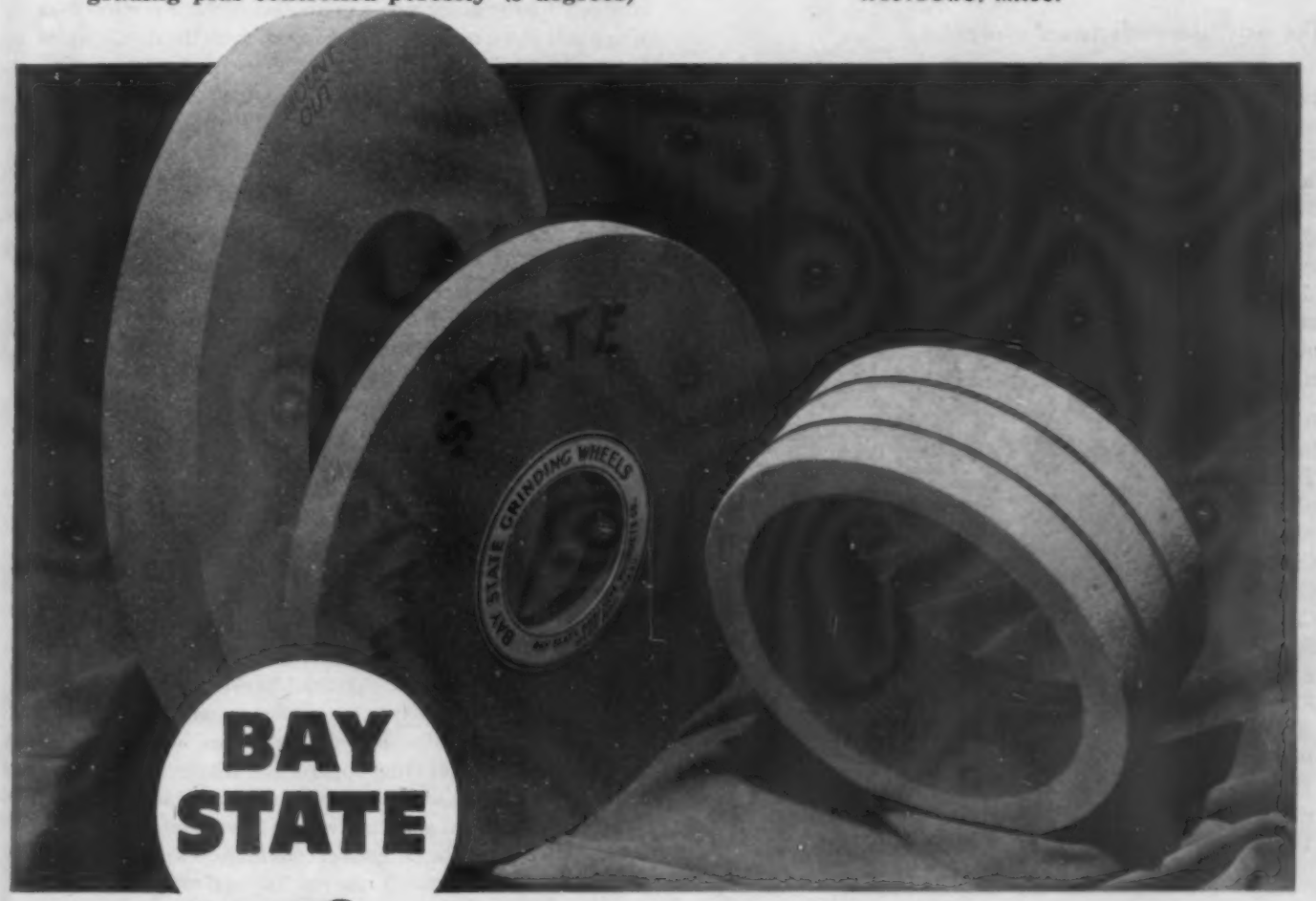
Cool. Bay State's own development in bonding — H9 vitrified (recommended for most surface and centerless grinding) — has *extra* strength, so less is needed to hold the abrasive grains. Wheels can be more porous, COOLER-cutting.

Bay State also offers a stronger guarantee of the same *results every time.* Fractional grading plus controlled porosity (8 degrees) permit very close duplication once a satisfactory wheel has been selected.

Bay State leadership in quality has been mounting during the war. Its acknowledged reputation for the finest honing and superfinishing stones, has extended rapidly into all the lines represented in the drawings below. And Bay State engineering offers specialized services to help you determine the exact wheel for your needs.

Make a test to determine if fractional grading plus other Bay State advantages won't give you better results. The first step is writing us for Bulletin A.

BAY STATE ABRASIVE PRODUCTS CO.
WESTBORO, MASS.



BAY STATE

BLUE FLASH GRINDING WHEELS *FAST and COOL*

HONING AND SUPERFINISHING STONES · CUT-OFF WHEELS · INSERTED NUT DISCS AND CYLINDERS · PORTABLE SNAGGING WHEELS · MOUNTED WHEELS AND POINTS · GRINDING WHEELS

for today there is not the hectic buying of a year ago and merchandise now must be better styled and better made. Sure, we've got a lot of samples tucked away—for we've been able to maintain our staff designers and research department too, and when the war ends we'll be ready to go with practically no reconversion problems."

And so it goes in molding plants where mass production of proprietary items has always been the rule and where the whole theory of mass production is to give the public a better product for less money. A pioneer tool maker epitomized the general outlook with, "Certainly larger and larger articles are going to be produced from plastics, but molders in this field will continue to specialize in small items. They have developed their markets for their own specialties which they have constantly improved; they have maintained customer loyalty, and as materials and new machinery become available they will expand and continue to supply the vast postwar markets with the even wider variety of articles they know the public wants. There won't be many reconversion problems up here.

"New competition? Yes—but a lot of it will come from old-line metal companies who are setting up plastics planning departments with an eye to the broadened potentialities of combination plastic and metal articles."

The material manufacturers' viewpoint

Any suggestion that the material manufacturers are not concerned with the ultimate use of their products would be contrary to fact. They watch over their many formulas like a mother hen over her brood of chicks and, for the general welfare of the industry, try to control their destiny. The advertising and sales departments of the materials producers visualize a more varied than ever application of their raw stocks, but they are by no means forgetting small wares. One of the old-line organizations which produces a complete range of materials submitted the following list of finished articles compiled from recent requests for information as an indication of end users' continued interest in small stuff:

Bathroom fixtures	Radio cabinets
Plastic dinnerware	Fly fishing boxes
Tumblers	Fishing lures
Serving trays	Refrigerator ice cube trays
Knives	Refrigerator dishes
Cutlery	Citrus fruit squeezers
Coasters	Novelties for the home
Chisel handles	Funnels
Spoons	Cookie molds and cutters
Kitchen mixing bowls	Fishing floats
Kitchen measuring cups	Oilers (transparent)
Shower curtain rods, hooks	Strainers (kitchen use)
Photograph frames	Clothes hangers
Flower vases	Vegetable graters
Flashlights	Basin and sink stoppers
Toys	Clothes pins

Another indication of the greater-than-ever interest in small plastic wares is the visits of departmental buyers from one of the country's great mail-order houses to New York and other centers of the plastics industry to study the potential applications and adaptations of molded articles to their lines. The promotional departments of the material manufacturers are too alert to the possibilities in such relations to fail to do a bang-up selling job.

Most of the articles listed above were familiar in hardware, dime, variety and department stores until about a year ago, but such shelves present an Old Mother Hubbard appearance today. Buyers and salespeople report the public misses the colorful and useful array of plastic wares, quickly grabs what little becomes available and will have the glad hand of welcome out for plastics' return. Materials manufacturers have kept a finger on the buying pulse with an eye to the future.

Many articles from the above list would lend themselves to premium use—a field the manufacturers aren't overlooking either, especially in view of the inevitable play the light metals industry will make to guide a part of its vastly increased productivity into this big-tonnage-consuming channel. (And incidentally, it is this specter of greater-than-ever competition that is causing the materials producers to advise their molder customers to get hot on the trail of orders now.) Well remembered is the tonnage represented in the Lone Ranger whistle, Colgate's ocarina, the Ovaltine drinking mugs, the Red Heart dog tags, the Frigidaire banks, Johnson's Wax key-chain bracelet, the millions of miniature animals which decorated once plentiful whiskey bottles, the infinity of stirrers and muddlers the public took home from bars and night clubs. They or their modernized successors will be in demand again and the manufacturers know it.

Still another angle to which materials producers and molders alike aren't blind is a long list of articles now produced exclusively for use in one phase or another of the war effort, but which will find a ready civilian market, come the day. Molds for model airplanes and boats now used in identification study, terrestrial globes for teaching navigation, canteens, compasses, flashlights, et cetera, aren't likely to be destroyed when their war service is ended. Won't the youngsters be proud of their scale-model P-38's, B-29's and really accurate match box compasses? And what boy won't want an army or navy canteen or a plastic bugle?

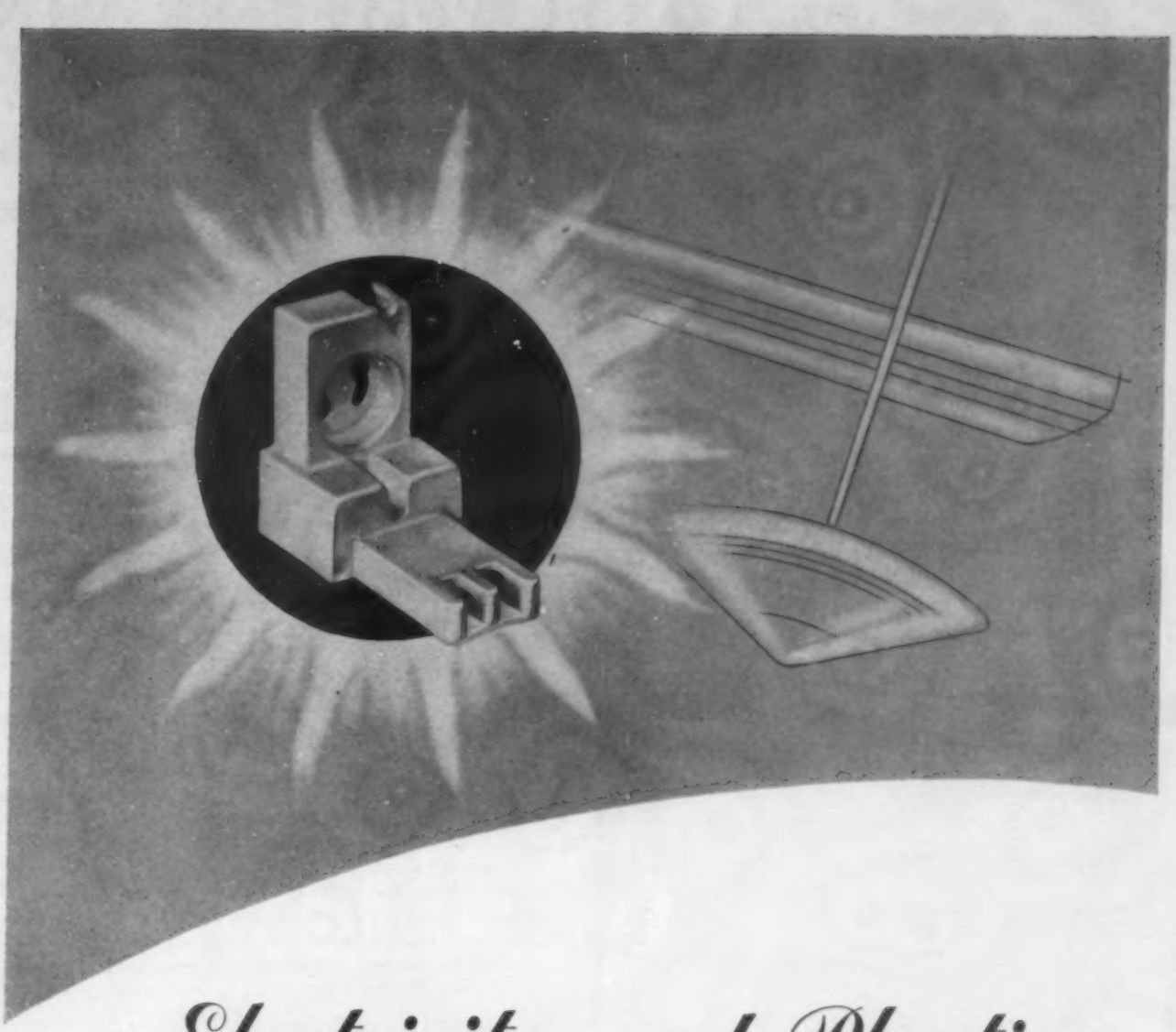
The plastics industry probably isn't any more postwar conscious than any other, but with its reconversion problems fewer than most, it is logical and nothing more than good business judgment to be ready to produce for an avid civilian market. It will not be a big hurdle for the material manufacturers. By the addition of now-scarce pigments they will once more be able to cater to a color-conscious world.

Proprietary molders will shine up the old stock molds and begin to fill the great volume of orders long since booked for delivery on V-Day. Most of them—proprietary and custom—will welcome the transition to civilian production for the sake of their profits. War orders have kept plants busy 24 hours a day, 7 days a week, but long profits on such production just haven't existed. Many tell of the items they get 10 or 12 cents for which would bear a 59-cent price tag at retail; and that much differential between producers' and retailers' prices reflects the close profits on war production.

Let the dreamers dream of plastic houses, airplanes, automobiles, furniture, wearing apparel and whatever; but while their pipes—plastic, of course—lull them into plastic fantasies, thousands of tons of materials will be flowing into molds from which will emerge the millions of colorful pieces of small wares the everyday world stands ready to buy and use.

Acknowledgments

The staff of MODERN PLASTICS is indebted for assistance in the preparation of this article to the many individuals in the premium and retail fields who so generously consulted their records for information and gave valuable suggestions and advice. Similarly, we thank the numerous molders and materials men who granted interviews, supplied data, and in general gave us the benefit of their years of experience.



Electricity and Plastics

A dynamic combination . . . now and in the future . . . energy harnessed to serve man's need for light and power. In the field of lighting a greater use of plastic parts should result in lighter weight fixtures produced at lower cost. The favorable electrical properties of plastics further recommend their use in all electrical products. Our facilities are ideally set up to serve the requirements of lighting fixture manufacturers . . . and of electrical manufacturers generally. As custom molders with a production viewpoint, we welcome inquiries which offer us an opportunity to apply new techniques and standards developed during these war years. War jobs still come first at PYRO but we are glad to discuss the production of postwar and essential civilian products anytime. You are invited to visit us at Westfield . . . or ask us to call.

THE PYRO PLASTICS COMPANY

WESTFIELD • NEW JERSEY

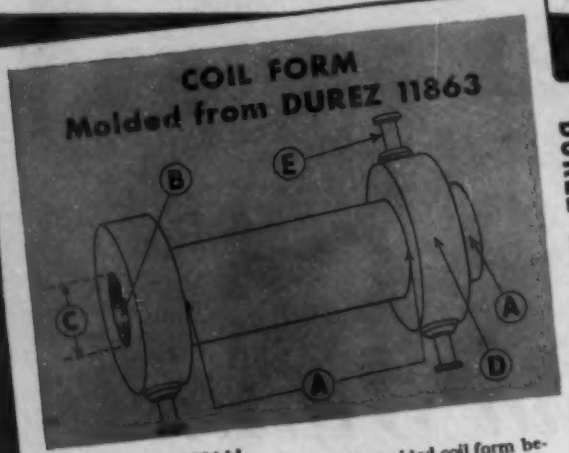
Eighth in a series of plastics applications.

Plastics Performing Unsung "in the Ranks"

NOT so imposing as a battleship, tank or plane, this small plastic part nevertheless has a significant role in war.

A coil form for communications in the Armed Forces, it is one of the thousands of plastic parts that are serving in all types of war equipment on all battle-fronts.

28 years of experience in plastic molding enabled Aico to produce this part . . . rapidly and inexpensively . . . complete with metal inserts in a single molding operation.



MOLDING MATERIAL
Durez 11863 was selected for this molded coil form because it is a "low loss" material with additional advantages of pronounced hardness, strength and resistance to deteriorating agents.

MOLD DESIGN
A split-cavity, compression mold was designed to produce the part. The 2 splits form the cylindrical body (A) and are ejected from the mold proper with the piece. A pin, anchored to the bottom of the mold, forms slightly tapered hole (B) through center maintaining a tolerance of + .003 at (C) . . . a telescoping piston is forced downward to mold the continuance of body (A) above flange (D).

INSERTS
Inexpensive assembly and greater stability are advantages of molding metal inserts (E) into the part in a single molding operation. This called for skilled mold design and construction so that the part would not be weakened around inserts. Inserts were placed where the split-cavity of the mold joins for ease and accuracy in molding.

Write for additional copies of Aico's plastics applications file cards Nos. 1 to 8.

Aico PRECISION MOLDING
29th Year

AMERICAN INSULATOR CORPORATION, New Freedom, Pa.
Sales Offices: BOSTON · BRIDGEPORT · BUFFALO
CLEVELAND · DETROIT · NEW YORK · PHILADELPHIA

News of the industry

(Continued from page 158)

★ ANNOUNCEMENT OF A NEW RESIN PLASTICIZER which is said to possess high resistance to oils, gasoline and heat and to show unusual promise in polyvinyl chloride cable compounds and cable lacquers, wire enamels, vinyl resin fabric coatings, hot-melt compositions, and aircraft gaskets and caulking and sealing compounds, marks a new step in chemistry's effort to perfect and enlarge the application of synthetic rubbers. Known as Paraplex G-25 and developed by the Resinous Products & Chemical Co., this synthetic resin is a saturated polyester, thermoplastic and chemically stable, and can be used for all polyvinyl chloride resins and elastomers of the acrylonitrile butadiene type.

Compounds in which it is used are essentially non-volatile and exhibit very low flammability, good plasticity, water resistance and excellent stability on exposure to ultraviolet. Because of its unusual resistance to hot oil and its good low-temperature flexibility, it has proved unique as a plasticizer for Buna N type stocks and is now going into nitrocellulose lacquers where permanence and non-migration of the plasticizer is important. Although tests have not been completed in this field, its physical properties indicate that eventually it may be used in many types of resistant coatings which must come in contact with foods.

The resin is readily soluble in esters, ketones, aromatic hydrocarbons and chlorinated hydrocarbons. It is soluble in aromatic naphthas but is insoluble in aliphatic hydrocarbons. Although the resin will not dissolve in alcohols, it will absorb up to 25 percent ethanol and 30 percent butanol. It is highly compatible with the vinyl chloride resins, synthetic rubbers of the Buna N type, cellulose nitrate, chlorinated rubber, and certain thermosetting resins of the phenol formaldehyde type. Paraplex G-25 is also compatible with Buna S, neoprene, cellulose acetate propionate and polyvinyl butyral. When in solution this resin plasticizer is incompatible with ethyl cellulose, cellulose acetate and cellulose acetate butyrate. It is supplied as a soft, tacky, viscous liquid which pours slowly at room temperature.

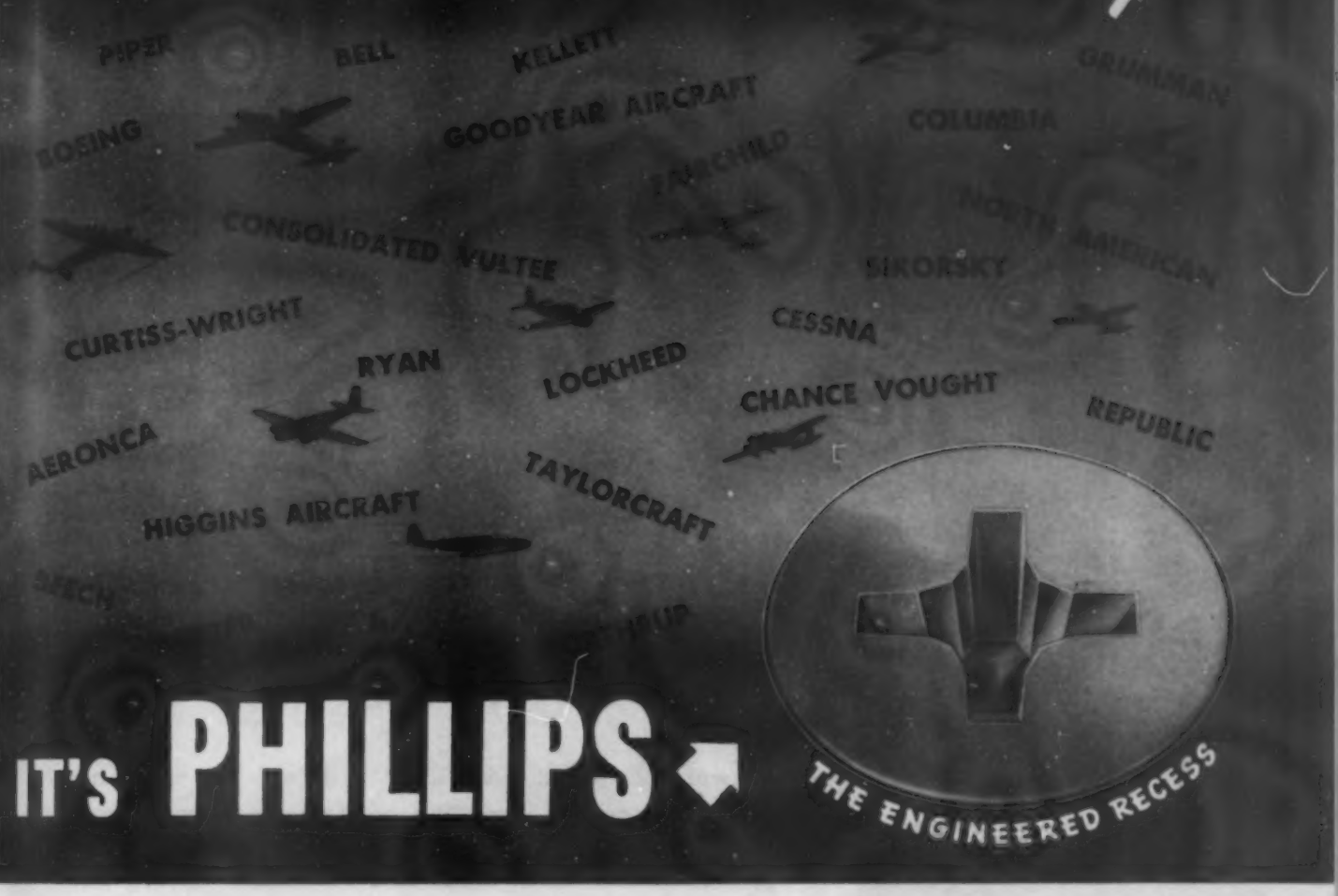
★ THE PULP AND PAPER COMPANIES OF THE STATE of Washington have appropriated $300,000 to the University of Washington to study the development of lignin in plastics. The money is to be given at the rate of $60,000 a year for 5 years.

★ CHEMICAL DIVISION OF B. F. GOODRICH CO., Akron, Ohio, is offering to industrial users a group of unique polyvinyl resins under the name of Geon. According to J. R. Hoover, general sales manager for plastic materials, the new resins can be processed easily on existing equipment and will expand the field already served by this type of material. Among the principal uses of these resins is the coating of fabrics, paper, foil and other materials, the insulation of wire, the making of film for packaging, and the manufacture of extruded and molded products. Plastics made with these resins combine rubber-like properties with non-flammability and resistance to oxidation. Because these materials can be varied so widely in useful properties, it is to the advantage of the prospective buyer to consult the manufacturer in choosing a compound to fit a specific need.

★ NEW ANTI-FOULING PAINTS CURRENTLY BEING tested by Hercules Powder Co. contain a resin chemical which is helping to lower the Navy's "barnacle bill." This resin, Hercolyn, acts as a plasticizer, keeping the paints open and soft, and leaving the poisons free to protect the surface of the vessel from accumulating barnacles.

★ A NEW THREE-IN-ONE GLUE, "8-9XC-U," HAS BEEN formulated by I. F. Laucks, Inc., Seattle, Wash. This glue, Lauxite Hot Press Urea Resin, can be used 3 different ways—straight, with a fortifier (to meet standard 3-hour boil test), and with wheat flour of any gluten strength. It is said to cut costs, inventory and production time.

Which RECESSED HEAD SCREW DOES THE AVIATION INDUSTRY *Okay?*



IT'S PHILLIPS

IT'S GOT TO BE RIGHT! The aviation industry knows its engineering . . . knows the answers to production efficiency. That's why most of the leaders in this industry selected the PHILLIPS Recessed Head.

You'll choose the Phillips Recess, too, once you study its exclusive design. You'll appreciate the scientific engineering that makes it so successful. You'll discover that every angle, every dimension has a purpose – is important to screw driving efficiency and screw strength. You'll agree there's nothing like it!

To end the screw driving troubles that slow down production and shove up assembly costs, specify screws with the Phillips Recessed Head. You can get them in any head style, type or size.

TO MAKE WARTIME QUOTAS AND PEACETIME PROFITS

FASTER STARTING: Driver point automatically centers in the Phillips Recess . . . fits snugly. Fumbling, wobbly starts, slant driving are eliminated. Work is made trouble-proof for green hands.

FASTER DRIVING: Spiral and power driving are made practical. Driver won't slip from recess to spoil material or injure worker. (Average time saving is 50%.)

EASIER DRIVING: Turning power is fully utilized. Workers maintain speed without tiring.

BETTER FASTENING: Screws are set-up uniformly tight, without burring or breaking of screw heads. The job is stronger, and the ornamental recess adds to appearance.

PHILLIPS Recessed Head SCREWS

WOOD SCREWS · MACHINE SCREWS · SELF-TAPPING SCREWS · STOVE BOLTS

IDENTIFY IT!

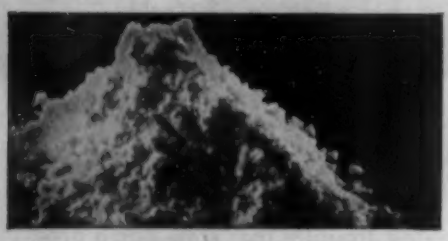
Center corners of Phillips Recess are rounded . . .
NOT square.

Bottom of Phillips Recess is nearly flat . . .
NOT tapered to a sharp point.

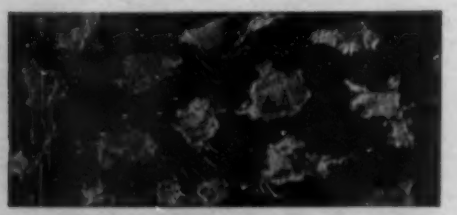
23 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

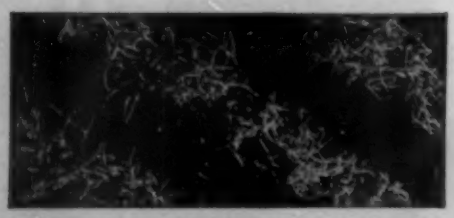
Let RAYCO help you find the filler that's EXACTLY RIGHT for your plastics



FILFLOC Pure cotton flock of surpassing cleanliness and uniformity.



FABRIFIL Macerated cotton fabric for extra strength; uniformity assures good flow



CORDFIL Evenly cut lengths of tire cord; for plastics of utmost strength.

We work closely with molders and their compound manufacturers, in finding the ideal fillers for varying requirements. It has been demonstrated conclusively that small adjustments in fillers often produce marked improvements in the finished plastic. Rayco's broad fund of experience on this subject is "yours for the asking." We invite you to take fullest advantage of it, as well as of our facilities for producing a very high grade of fillers in volume to meet urgent schedule requirements. While we manufacture three general types of fillers—as described at the left—a most important phase of our service to the Industry is the skillful modification and adaptation of these basic types so that you obtain the MAXIMUM benefit which the right filler can bring to your product.

Occasionally we are asked to render cutting service on products outside our line. We are glad to consider such requests.

RAYON PROCESSING CO. of R.I. INC.

60 TREMONT ST., CENTRAL FALLS, RHODE ISLAND

Developers and Producers of Cotton Fillers for Plastics

HOW TO CEMENT PLAX POLYSTYRENE

Three different types of cement can be used with polystyrene.

1. Solvent. Cementing with a solvent is similar in principle to welding. The solvent softens the polystyrene surfaces to be joined. The surfaces are held together under light pressure. The softened surfaces unite. The solvent is absorbed by the body of the plastic and the joint becomes solid and rigid. In this method, surfaces must fit exactly before the solvent is applied. Machined surfaces are usually cemented by this method.

2. Polystyrene solution. A thin layer of dissolved polystyrene is spread over the surfaces to be joined. The pieces are held together under light pressure. The solvent in the solution evaporates or is absorbed, leaving a joining layer of solid polystyrene. This method of cementing does not require perfectly fitting surfaces because the dissolved polystyrene in the cement will fill small surface irregularities. However, close tolerances cannot be maintained because the dissolved layer of plastic will vary with each application of cement. The bond will take from 12 to 36 hours to dry because a large amount of solvent is introduced at the joint. This method of cementing can be speeded by using a thicker solution, which has been warmed to make it fluid. Thus the amount of solvent to be evaporated is reduced.

3. Adhesive. This can be used to join polystyrene to other materials and to metal. The Thiokol, Glyptal, and Reanite Cements are variations of this type. These cements are classed broadly in three categories: drying adhesives, non-drying adhesives, and curing adhesives. The drying adhesives are most commonly used. The non-drying materials are weak in shear but extremely resistant to vibration, while the curing adhesives are temperature resistant. When partially cured, such adhesives give welds having a high degree of vibration and temperature resistance.

When cements employing a polystyrene solvent are used, and most cements do, the unit should not be stressed or assembled until dry. The solvent softens and weakens the polystyrene. If a load is applied, before the solvent evaporates and the plastic becomes rigid, the chance for distortion or cracking is great.

In many instances, heat sealing may be used instead of cementing.

PLAX POLYSTYRENE IS SUPPLIED in sheets, rods and tubes. It is also available in the famous Polyflex* Sheet and Polyflex* Fiber, tough and flexible extruded forms with wide insulation application. Machined parts such as those shown above (in actual sizes) are produced by Plax, to your specifications. Plax also supplies a polystyrene cement.

Other Plax wartime production includes various forms of cellulose acetate, cellulose acetate butyrate, ethyl cellulose, methacrylate, and styramic.

Write for bulletin on "Fabricating Polystyrene," containing full details of polystyrene's properties.

*Trade Mark Reg. U. S. Pat. Off.

PLAX
FOR PLASTICS
NOT SUBSTITUTES — IMPROVEMENTS
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SIMONDS SAWS speed plastic-cutting in PAN AMERICAN AIRWAYS' new Miami maintenance building

To service the fleet Clippers that link the continents, Pan American World Airways System has completed its largest maintenance building, covering 2½ acres west of the Miami passenger terminal.

Here, where 12 to 18 planes can be serviced at one time, speed is vital on all work. So Simonds Circular Saws are used on many operations like the one shown . . . in which a 10" high speed saw is cutting sheet plastic which goes into everything from radio dials to cabin windows.

America's most experienced saw-makers produce tools to cut plastics of all types . . . and to cut them faster, smoother, straighter, with longer operating intervals between grinds. Have your Industrial Supply Distributor bring a Simonds engineer to take a quick, first-hand look at your cutting operations *(no long-drawn-out paper survey)* . . . and see what he can do to help you increase production and increase the life of your cutting tools. Get in touch with your dealer *today*.

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SIMONDS SAW AND STEEL COMPANY
FITCHBURG, MASSACHUSETTS

PRODUCTION TOOLS FOR CUTTING METAL, WOOD, PAPER, PLASTICS

Hocus Pocus...Ladies and Gentlemen

A Post-War Cow!*

1 Now, wait a minute, professor . . . why all the hubbub? That's no different than a pre-war cow! After this war is won, many an item will look exactly the same as it did before. So let's not get excited about "Post-War Cows".

2 Let's get excited about the job plastics can do after this war is won. Creating new products of plastics . . . creating better products with plastics . . . that's what we like to do at Precision Plastics Company. If your product is a "Post-War Cow", we urge you to return to the proper material. However, if it lends itself to plastics, write us today. Let our engineering department work with you. We can help you plan for your post-war world!

3 Let's do get excited about the Precisionometer handle. Part of a precise inspection instrument . . . lighter, stronger, more durable even than required. No "Post-War Cow", this handle will continue to be manufactured of plastics, during peace-time, also.

PPC PRECISION
PLASTICS COMPANY
1724 W. INDIANA AVE., PHILADELPHIA 32, PA.

* We know that despite war-time shortages many items are being made of their original materials. These items are not adaptable to plastics. We also know of many cases where plastics are being used simply as substitute material. When we return to normalcy those items will again be manufactured of their pre-war material. Two good examples of what we mean by "Post-War Cow"!

A New Name for a Very Old Yankee Manufacturer

WATERBURY COMPANIES, INC.

KNOWN for many years as The Waterbury Button Company, this 132 year old Connecticut manufacturer has changed its name to Waterbury Companies, Inc. While button manufacturing is and will continue to be a division of this Company, it is nevertheless but one of six separate divisions manufacturing a great diversity of products. Time and change have brought about a need for a new name.

WC INC 1812

PLASTIC MOLDING
PLASTIC LIGHTING FIXTURES
METAL SUNDRIES
EYELETS
UNIFORM & DRESS BUTTONS

Our Engineers and Designers will work with you

A Modern Plant with the Equipment and Facilities for Volume Production

Today Waterbury Companies, Inc., is manufacturing thousands of plastic and metal products, most of which are identified with the war effort. Its modern and efficient plant is fully equipped for volume production.

Although largely engaged in essential war work, we are thinking about reconversion to peacetime production. Our engineers and designers will gladly plan with firms who are looking for a dependable source of plastic and metal products.

Buy More War Bonds
Hasten the Day of Victory

WATERBURY COMPANIES, INC.
Established 1812 • Department B
WATERBURY • CONNECTICUT

Found a "Fool-proof" Fastening Method *and* Hundreds of Work-hours Once *Lost* in Tapping

"We had to find a 'fool-proof' fastening method on our head phone assemblies," said engineers of the Winslow Company, of Newark, N. J., makers of electrical apparatus for the armed forces. And the simpler P-K Self-tapping Screw method proved the answer.

Fastenings were originally made with machine screws. The holes were small, and drilling and tapping were unusually difficult operations for inexperienced workers. Even when holes were properly drilled and tapped, "green" assemblers often stripped the threads in driving the machine screws. Spoilage of parts ran prohibitively high ... hundreds of work-hours were lost.

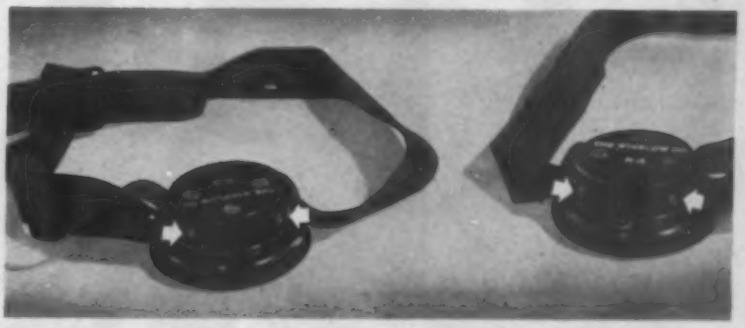
By switching to P-K Self-tapping Screws for this ticklish job, tapping and thread-stripping were eliminated. Spoilage virtually disappeared. Production picked up immediately. Fastenings were stronger than ever.

Question Every Fastening! – on the drafting board, and in production! Ask for a P-K Assembly Engineer to point out all metal and plastic assemblies on which Self-tapping Screws will end trouble, speed work, save money. Or mail assembly details for recommendations. Parker-Kalon Corporation, 190-200D Varick St., New York 14.

PARKER-KALON
Quality-Controlled
SELF-TAPPING SCREWS

Give the Green Light • to War Assemblies

EVERY WORKER A "SKILLED" WORKER! No special training or skill is required for this simpler fastening method. At the Winslow Co., inexperienced girls drive P-K Screws in tiny holes, and equal the work of veterans. You can change to Self-tapping Screws overnight!



MADE FAST – HOLD FAST! Four Type "Z" P-K Self-tapping Screws fasten two metal strap-retaining clips to plastic telegraph receivers. They form their own strong threads as they are driven, stay tight under severe stresses. The Winslow Co. also uses P-K Type "Z" Screws to fasten plastic sub-panels and ground wires to transformer cases of an ignition testing set.

TYPE "Z" THREAD-FORMING SCREWS

All purpose, *form* their own threads in the material. For fastening to cellulose acetate and nitrate compounds, methyl methacrylate resins, polystyrenes, laminated phenolics, and metal.

TYPE "F" THREAD CUTTING SCREWS

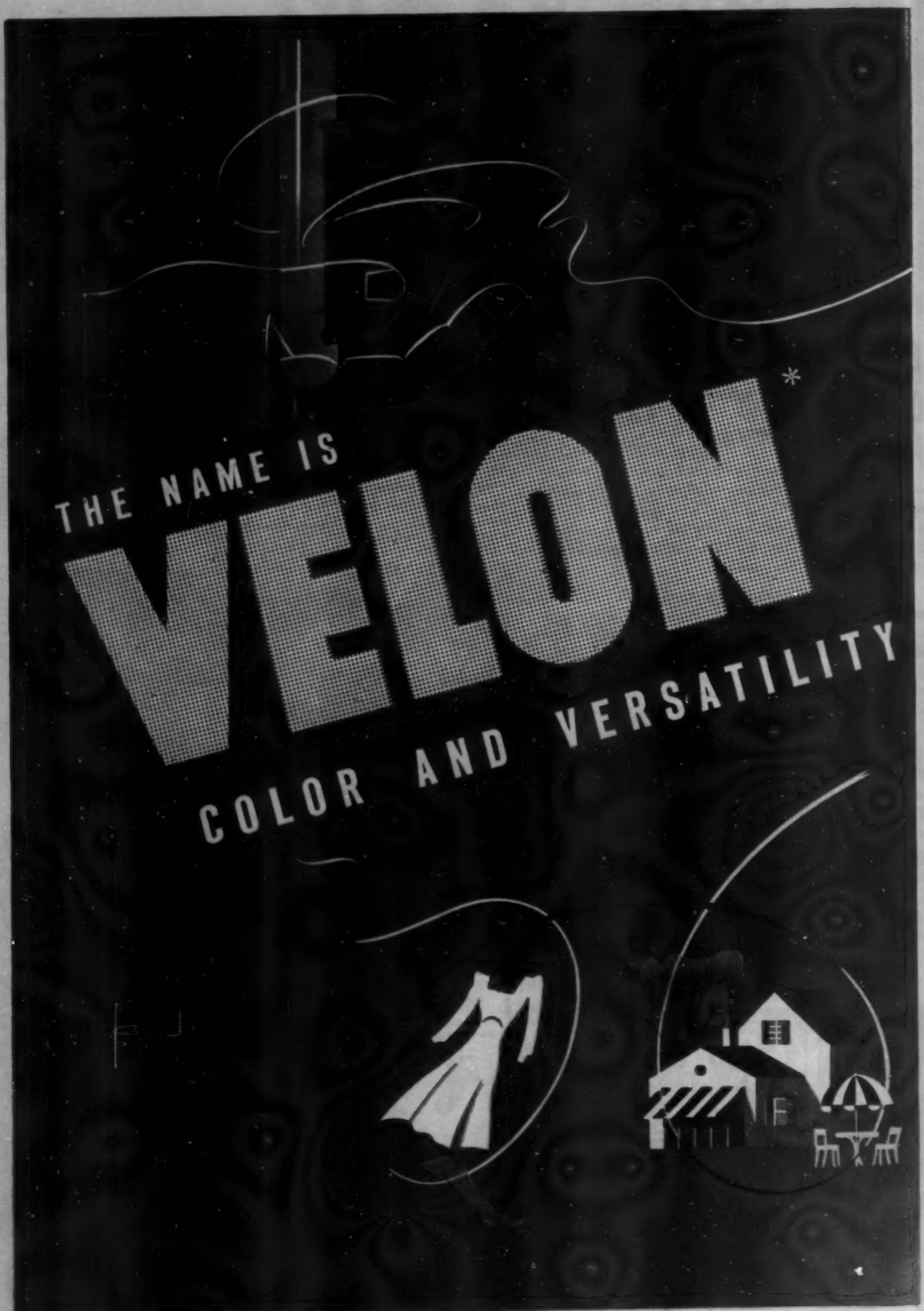
Expressly developed for use in crumbly and friable materials, such as phenolic and urea base compounds, cold mold compositions, and hard rubber. Also for metals. *Cuts* a thread like a tap.

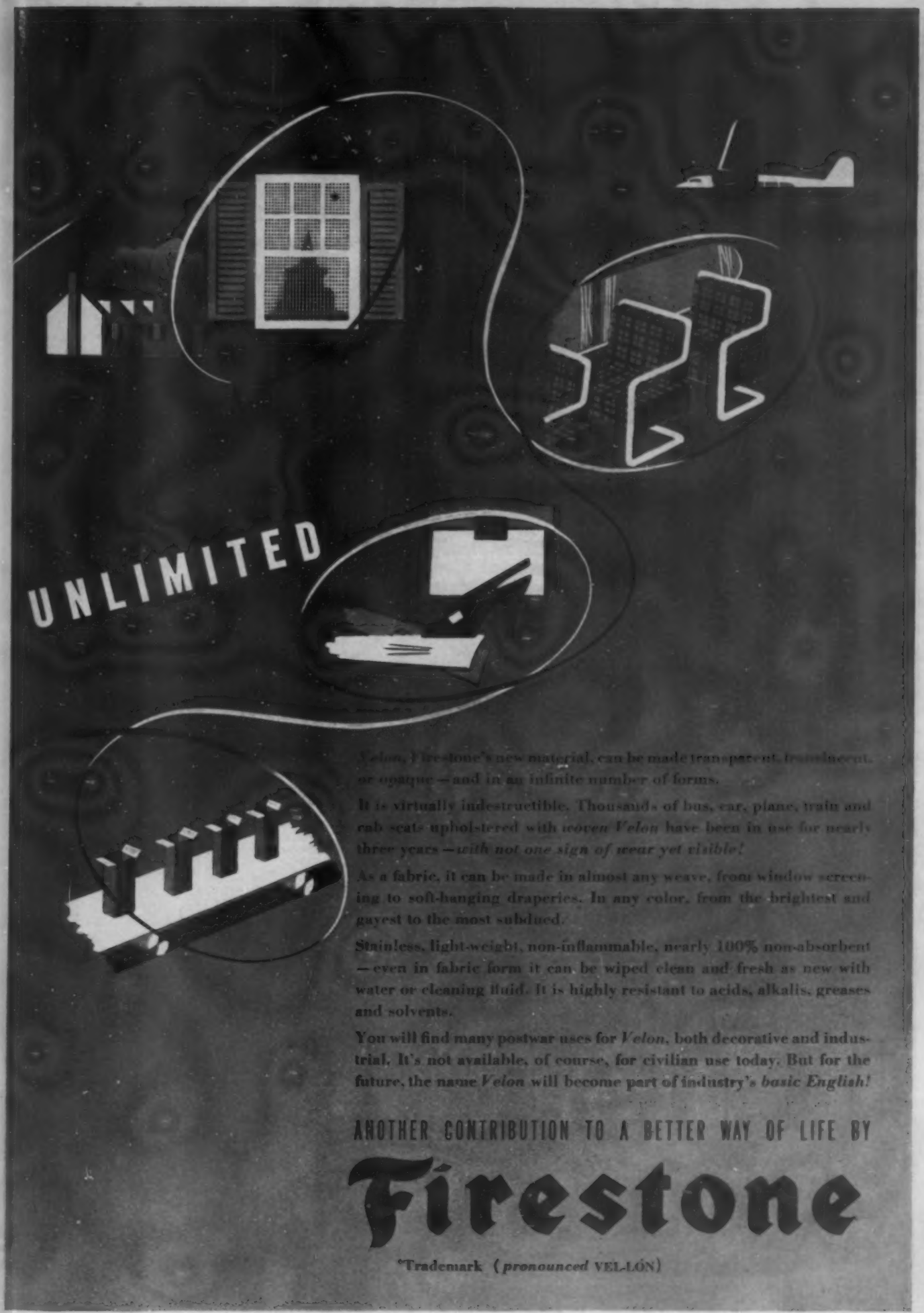
TYPE "U" – FOR PERMANENT FASTENINGS

For use in all kinds of plastics and metals. Hammered or otherwise forced into the material, it forms its own thread. Cannot be removed.

OTHER TYPES OF P-K SCREWS ARE AVAILABLE

A TYPE FOR EVERY METAL OR PLASTIC ASSEMBLY


THE NAME IS
VELON*
COLOR AND VERSATILITY



Velon, Firestone's new material, can be made transparent, translucent, or opaque—and in an infinite number of forms.

It is virtually indestructible. Thousands of bus, car, plane, train and cab seats upholstered with *woven Velon* have been in use for nearly three years—*with not one sign of wear yet visible!*

As a fabric, it can be made in almost any weave, from window screening to soft-hanging draperies. In any color, from the brightest and gayest to the most subdued.

Stainless, light-weight, non-inflammable, nearly 100% non-absorbent—even in fabric form it can be wiped clean and fresh as new with water or cleaning fluid. It is highly resistant to acids, alkalis, greases and solvents.

You will find many postwar uses for *Velon*, both decorative and industrial. It's not available, of course, for civilian use today. But for the future, the name *Velon* will become part of industry's *basic English!*

ANOTHER CONTRIBUTION TO A BETTER WAY OF LIFE BY

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Experienced technicians engineer your ideas all the way through design, molds and complete finish —by compression, injection, extrusion or sheet forming.

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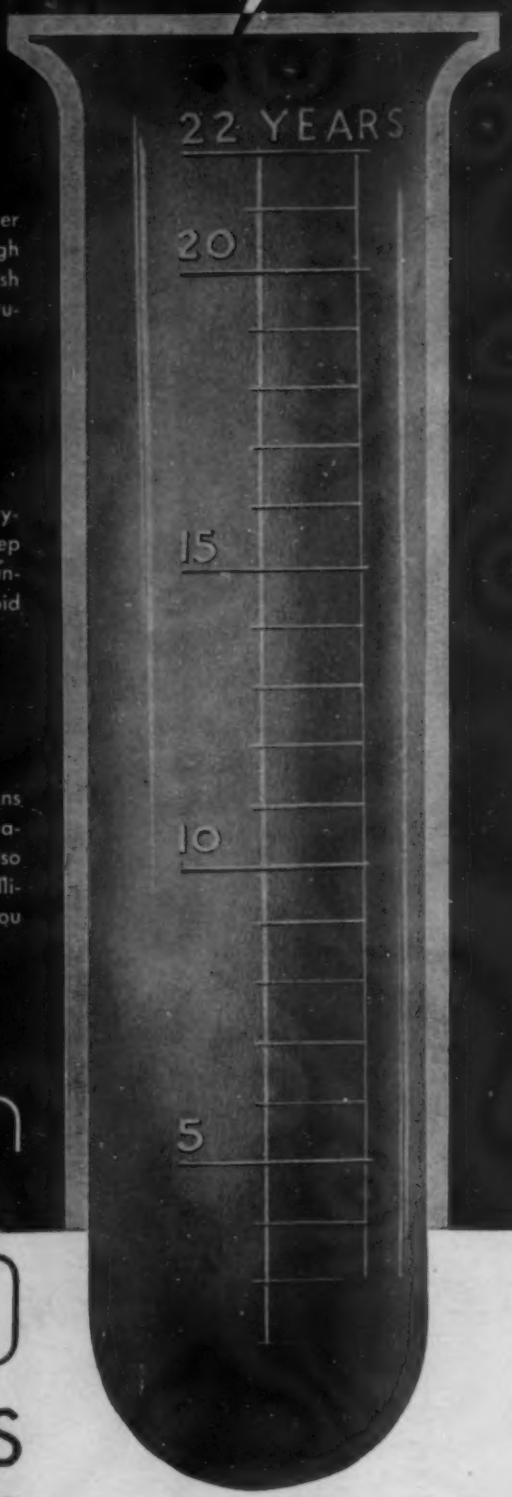
Plastic Molding by Reynolds means far more than just buildings, machinery, labor and material. It also means resourcefulness and intelligent ingenuity that will serve you well.



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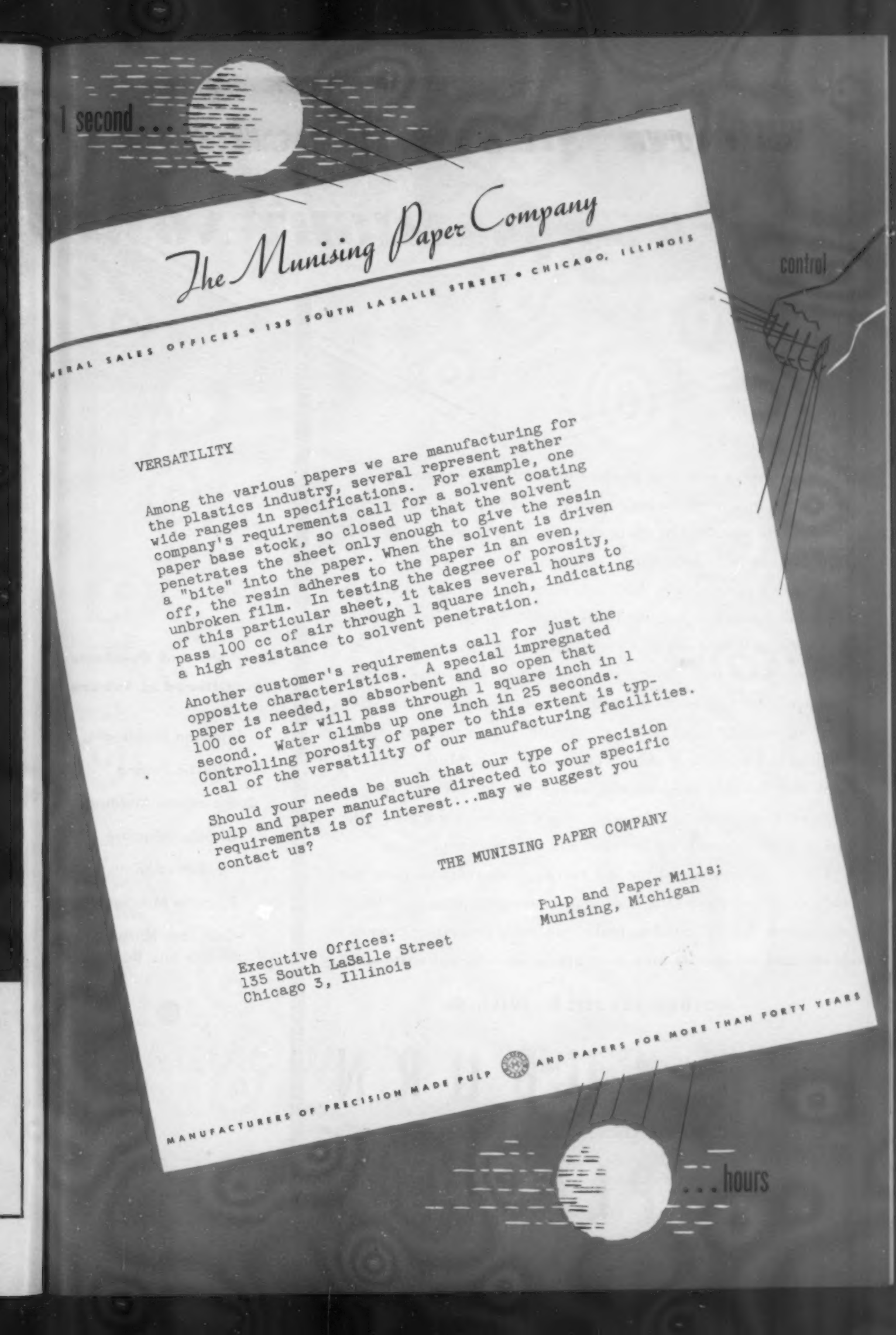
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Another customer's requirements call for just the opposite characteristics. A special impregnated paper is needed, so absorbent and so open that 100 cc of air will pass through 1 square inch in 1 second. Water climbs up one inch in 25 seconds. Controlling porosity of paper to this extent is typical of the versatility of our manufacturing facilities.
Should your needs be such that our type of precision pulp and paper manufacture directed to your specific requirements is of interest...may we suggest you contact us?
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We can't promise you deliveries right now, except on certain special items such as extruded tubing and cellulose nitrate sheets. But we can *deliver* when it comes to the application of plastic molding "know how" to the solution of your particular molding problem. Our engineers, backed by Auburn's more than sixty years of molding experience, can tell you, from your drawings or models, how and where plastics can best be used. More than that, they may be able to show you, before the die is made, how to increase your products saleability or profitability through a fuller use of Auburn's molding facilities and Auburn's experience.

Under the pressure of the last two or three years we have not only expanded those facilities but we have also piled up a lot of experience that is bound to make someone's peacetime products better and cheaper. It may be yours . . . so why not write now?

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Through continuous research we pass on to customers the benefits of our experience

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for the building field and for general industry.

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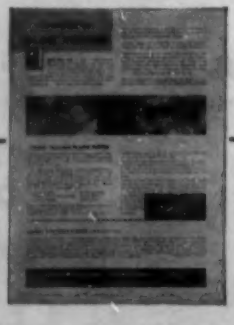
DATA SHEET

Upon request we will send you data sheet descriptive of TULOX TT tubing made from cellulose acetate butyrate and TULOX A tubing made from cellulose acetate showing physical properties and some standard sizes available together with prices. If you have special chemical or physical requirements we will be glad to work with you in the development of tubings to meet your individual needs.



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The strength, machineability, dielectric properties, stability of dimensions, moisture and acid resistence of Formica have caused its wide application in communications and other electrical uses. Now is the time to inquire about the interesting properties recent Formica research makes available for your post war products.

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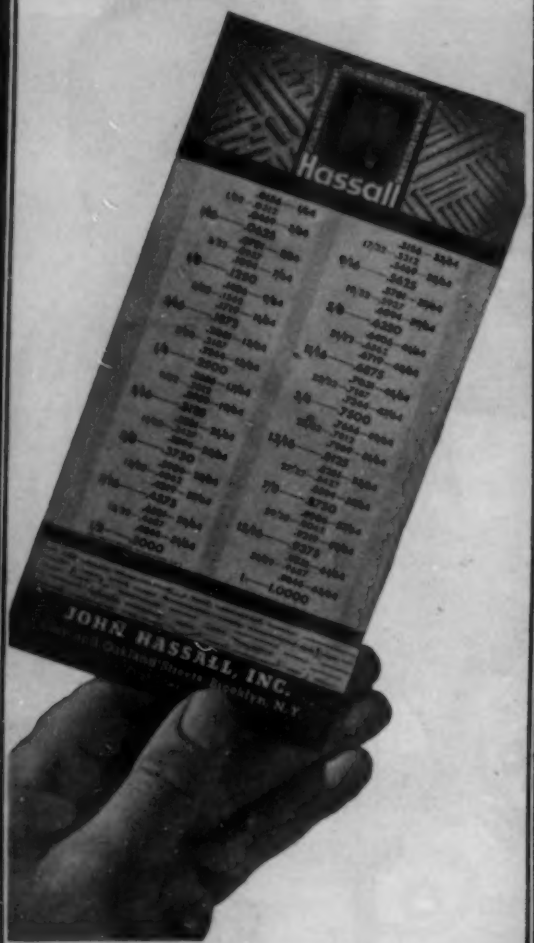

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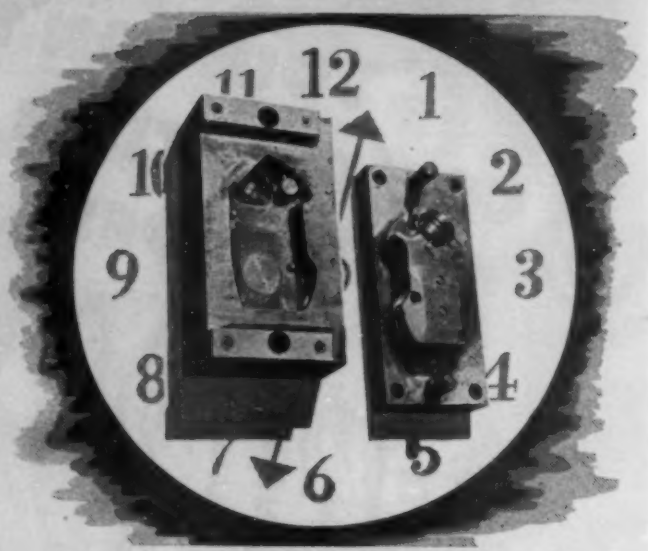

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The 125 hours required to make the above flashlight case mold and force may not be unusual, but more than three weeks of working time is an investment that needs every possible safeguard.

Today, more than ever before, it is important to answer the question, "How can I better protect the hours that go into mold-making and produce molds that meet such requirements as mirror finishes over long runs?" One of the best answers is to get the extra assurance of clean, perfectly uniform mold steels by use of Carpenter electric furnace mold steels—100% Acid Disc Inspected. Another good answer is to combine your knowledge of mold-making with Carpenter's experience in solving mold steel problems.

Your nearby Carpenter representative will be glad to put his mold steel experience to work for you. Call on him whenever the need arises.

"Tooling Up For Plastics" can help you get better protection for your mold-making hours. It is a 36-page summary of Carpenter experience in mold steel selection, hobbing, heat treatment, and many other subjects. For your copy, just write us a note on your company letterhead. (Free to users in the U.S.A.)

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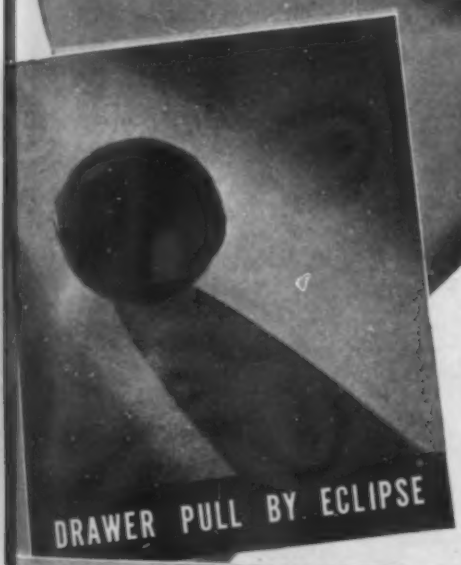

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PLASTIC

MOLDED PARTS

Many lessons have been learned, during the last few years, in simplification, substitution and speeding up of production. As makers of molded plastic parts FRANKLIN has profited by the experiences of these years. You are invited to call on us if you are planning on making any post war products, using plastic molded parts. We would like to tell you more about our qualifications and willingness to help. Give FRANKLIN a call if you are now using plastic molded parts or if there is some application in your present production in which they might find a place.

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WAR BONDS and STAMPS
★ ★

Franklin

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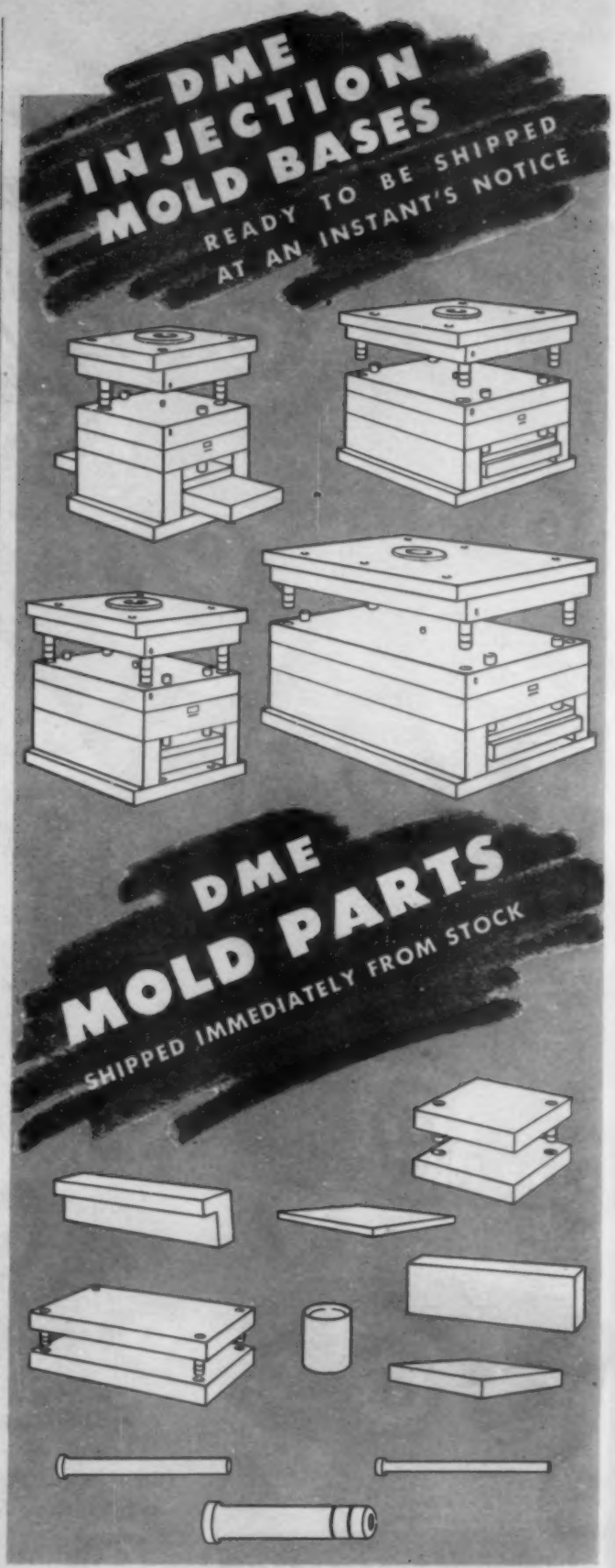
Robinson Industries Inc., — FRANKLIN, PA.



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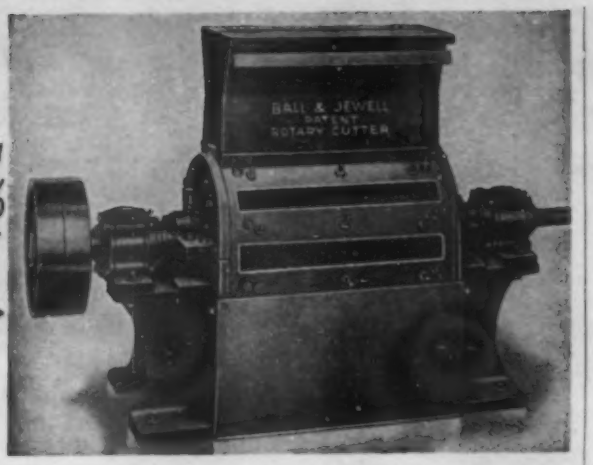

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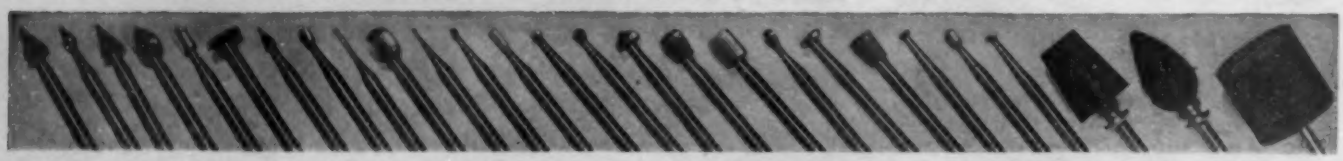

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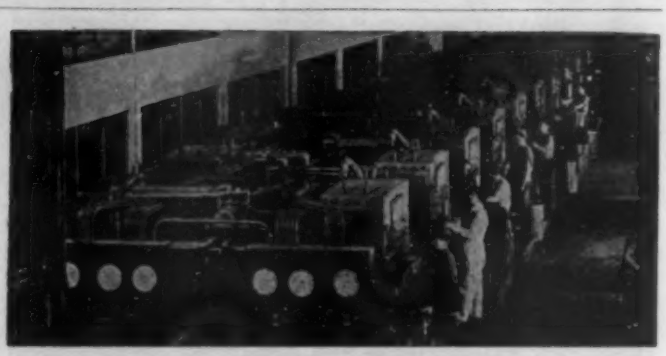

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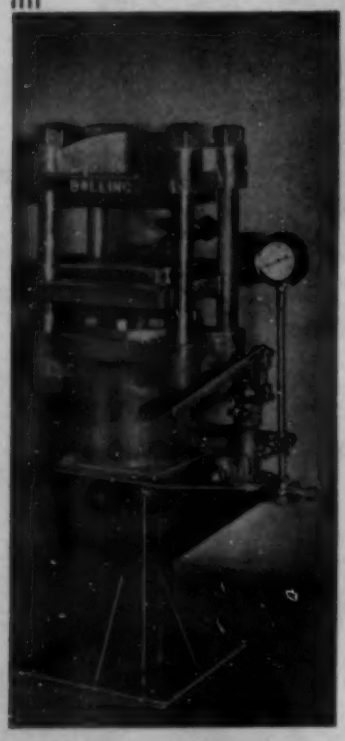

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Grade No. 161 3 mil alpha paper treated to a urea formaldehyde resin content of 58%. Natural color. Suitable for use as a translucent top sheet in the lamination of graphic panels.

The above grades of PHENOPREG UF are for low pressure lamination at temperatures of 280°F or lower.

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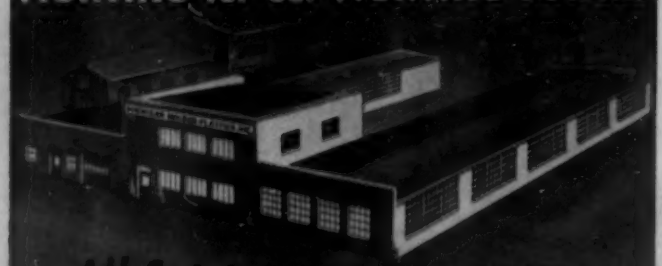

All Set for PEACETIME VOLUME

At this time our only thought is to get our boys back home and every effort we put forth is in this direction.

After this has been accomplished and once again we can turn all our efforts to a post-war era, we want to demonstrate our ability to fashion the better things to come in molded plastics.

Fundamental knowledge, advanced thinking and new techniques combined with experience and the ability to produce will again attract users to our plant — one of the * time-proven plants in the plastic industry.

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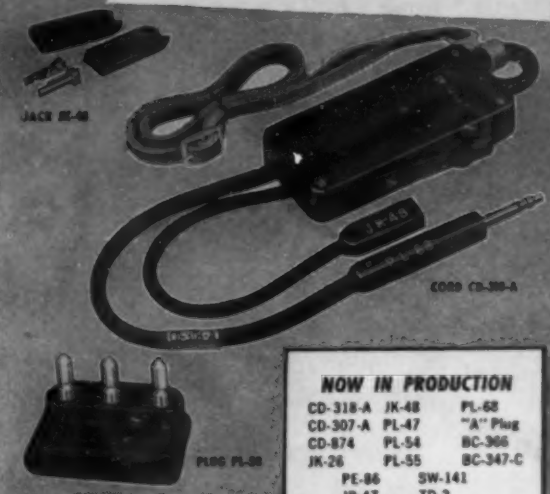

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Every product engineer knows that the same result can be achieved in a great number of ways—with different materials, different mechanisms, different types of construction—each resulting in satisfactorily doing the work required.

But commercial considerations make it of greatest importance that the result be achieved at lowest reasonable cost: this being particularly true of products in preparation for post-war markets.

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Steel, copper, aluminum, plastics, fibre cloth, wood—alone or in combination—require fastening. Maybe tubular rivets will do the job best, quickest or cheapest—maybe not. You will want to find out and we can aid you in so doing if you need facts to help make the decision.

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Uncle Sam during the past few years has discovered uses for tubular rivets which even we did not suspect. This experience has been gathered together, and along with accumulated pre-war experience, enables us to place our knowledge as riveting engineers at the disposal of you who may be reading this trade paper, now. May we help you?

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D-B NEWS

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ENGINEERS · DESIGNERS · MOLDERS OF PLAST

"War-Baby" Plastic Razor* Released to Serve on Home Front

IRVINGTON, N. J. — Under a recent WPB ruling, the collapsible plastic razor developed by Dillon-Beck for military use, will soon be made available for civilian distribution.

The transition of this product from war to ultimate large-scale peacetime use is a tribute to D-B ingenuity in product planning, and foreshadows many other possibilities in applying wartime plastics to new post-war functions.

Compact, non-rusting and non-corrosive, this lightweight all-plastic safety razor is fitted with a collapsible handle that telescopes to fit into a small plastic container. In use, the handle is firmly held to its full length by a patented taper design of the two handle sections.

"We use a 12-cavity die which molds six complete handles in one operation," explained a Dillon-Beck officer. "After molding, the smaller top section is dropped through the tapering hollow-bottom tube and the large end of the outside tube is sealed with a disk stamped from cellulose acetate sheet. The joint is then buffed and finished to give the appearance of one piece."

Due to its several advantageous features, a widespread civilian demand for this new razor is anticipated when quantity production can be effected.

*Pat. No. 2325751 Reg. U. S. Pat. Off.

DILLON-BECK MANUFACTURING COMPANY

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ALL TYPES OF HEADS AND THREADS

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This wealth of accumulated knowledge can be passed on to your customers who need ready-made insulation parts like our "Safety-Strain" insulators, our terminal blocks, our X-Ray shields of special X-Ray proof material; and to those who require custom-built moldings as well.

Experience is only one of the extras you get when you order your plastics from this Company.

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Famco builds 32 models of bench and floor type Arbor presses.

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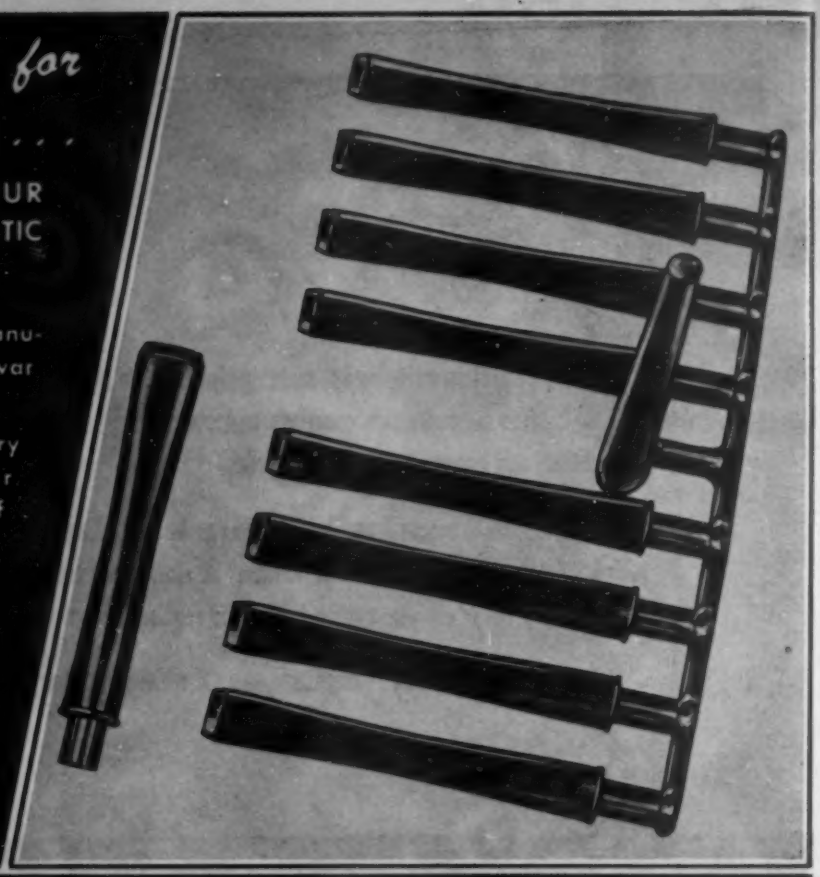

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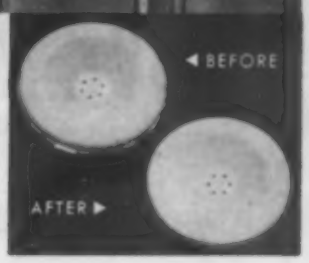

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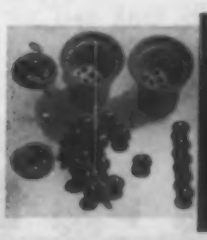

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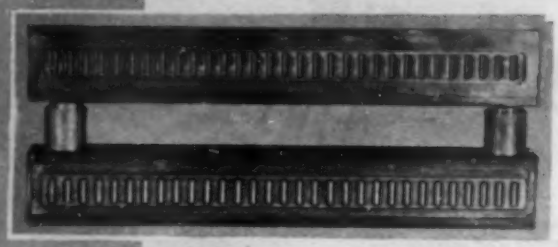

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Our plant is particularly well equipped to quickly produce micrometrically accurate deep hobbed cavity molds . . . molds produced under 2500 tons of pressure.

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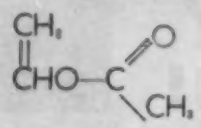
(STABILIZED)



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Exterior of Infra-Red Conveyor Belt Tunnel for removing moisture from plastic material prior to molding.

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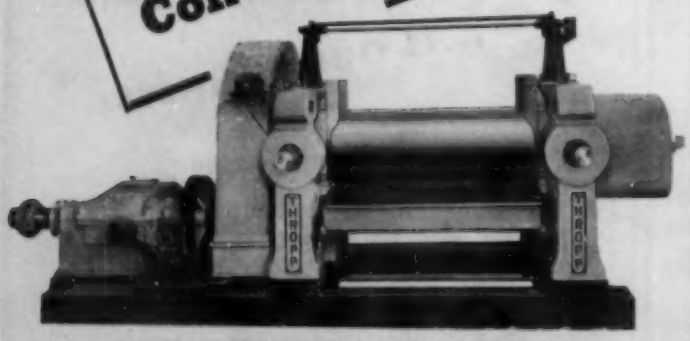

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If your post war plans for greater production call for special plastic machinery, we invite you to submit them to Thropp Engineers NOW.

They will gladly work with you in designing custom built mills for your particular requirements to enable you to convert quickly to peace time production. Write NOW!

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Select your Post-War PLASTIC SOURCE *Now!*

★ If your post-war products will require plastic parts in their construction, we suggest that you establish a source of production today to avoid the expected rush for plastics tomorrow.

Every day more manufacturers can see what their plastic requirements are to be and, consequently, they plan constructively for the post-war period and the great demand for plastic production that will come with it. We urge you, therefore, to consult with our engineering department now. Get cost-free advice from seasoned plastic experts. Your action now will help get your products on the market quickly when peace comes.

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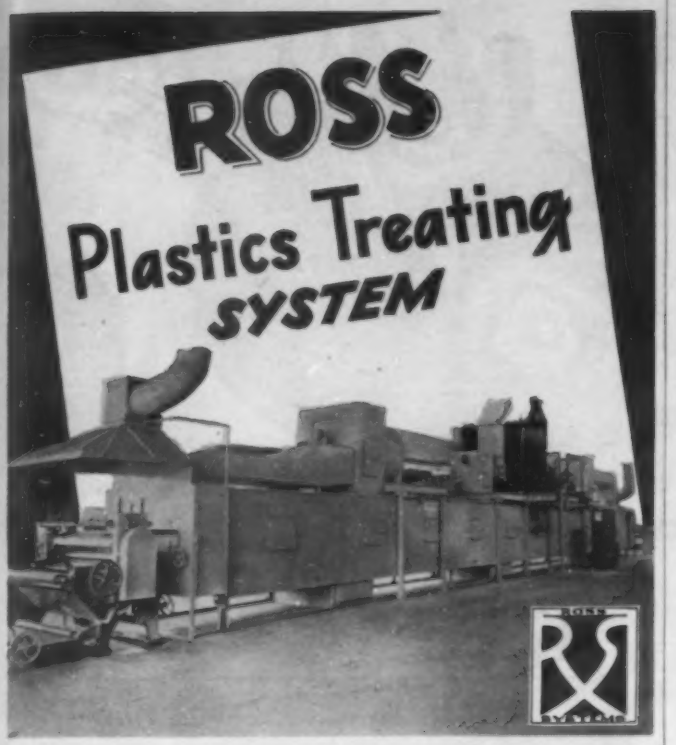

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The Metaplast Guild is a licensed group of Metaplaters, firms licensed to Metal Plate on Plastics under the patents of the Metaplast Company. In this group are firms which metal plate plastics for their own manufactured items and also firms which operate job shops.
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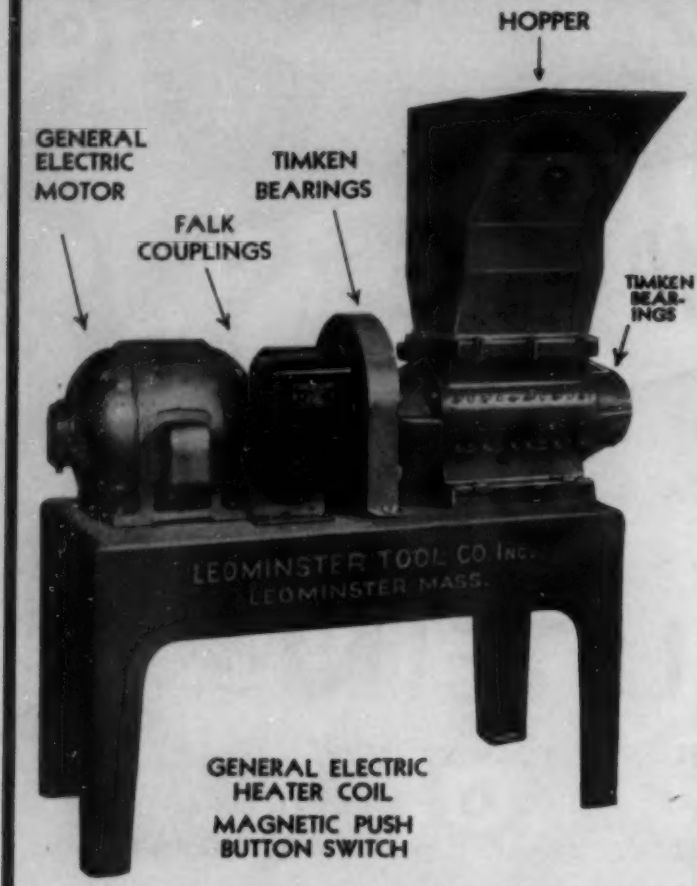

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46" x 18"		Floor space - 68" x 24"
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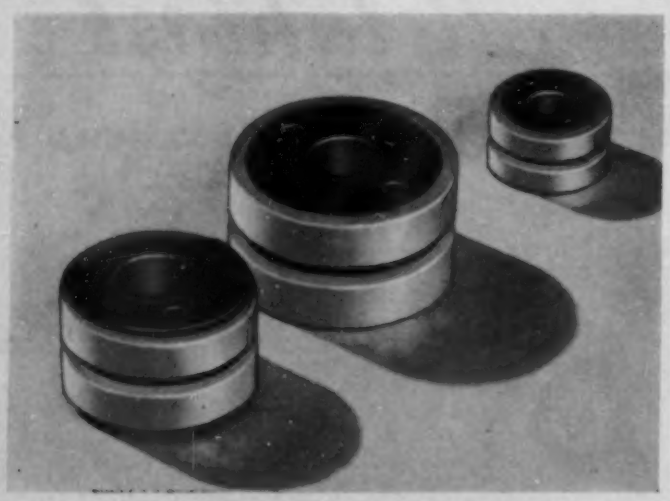

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Automatic Gas-fired

STEAM BOILERS

—are particularly suited to use with individual presses where critical temperatures must be maintained for quality molding. When placed beside the press, condensate returns to the boiler by gravity.

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Manufacturers of Automatic Steam Boilers for over a third of a century.
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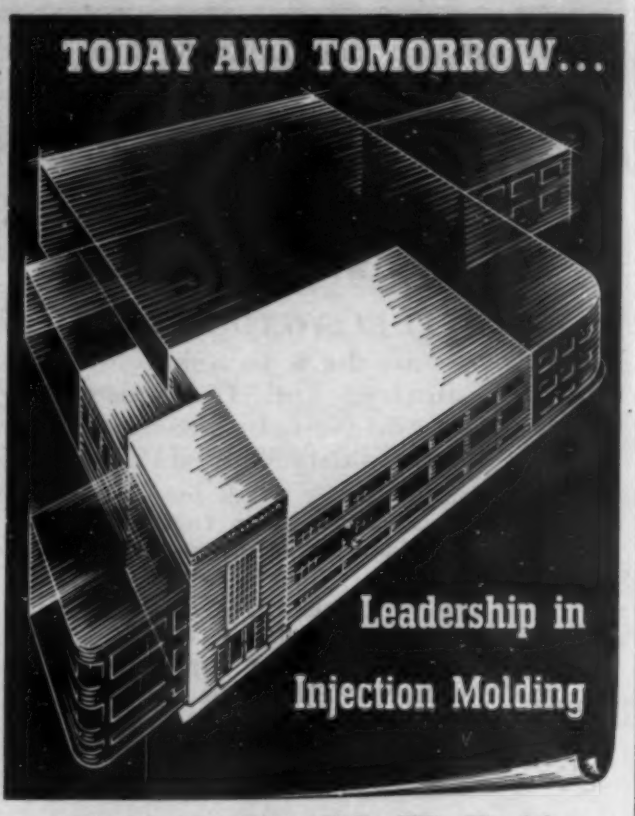

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It is being used for reducing high pressures—up to and including 6000 lb. per sq. in. and it does that job well—WITHOUT SHOCK. The medium may be water, oil, or air. For complete information simply ask about the

ATLAS Type "E"

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Every Part is "Just Right."

It is manufactured by a concern that has specialized exclusively in regulating valves for nearly a half century, hence every part is "just right." Founded on latest design and research it is modern in every respect. Forged Steel Body. Internal metal parts entirely of stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure.

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is an expression used by orators past and present to emphasize some point of great importance. The simple word *mark* has a singular strength of precise meaning. In the language of modern industry the word mark has an equally great significance.

Parts or containers *properly marked* move thru shipping and storage departments to places of use without a hitch. Inventories are recorded and checked easily and accurately. Receiving and delivery records are complete and informative. On assembly lines putting part to part and parts in place is made as simple as A-B-C through marking. Most material from paper to plastic. Almost any shape from a wire to a box with a wide range of surfaces being effectively handled. Marking with Markem equipment and compounds means marking durably and accurately at automatic machine speed.

Ask for Bulletin "Marking on Plastics" giving details of your marking requirement and sending samples of articles to be marked.

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MARKEM MACHINE COMPANY
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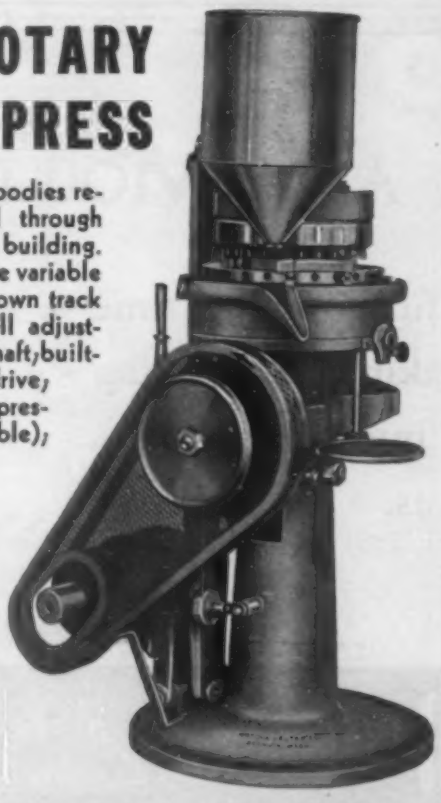

● New design embodies refinements achieved through years of machine building. New features include variable lower punch pull-down track plus micrometer cell adjustment, center drive shaft, built-in variable speed drive, automatic excess pressure relief (adjustable), low friction drive, 1 h.p. motor.

Other facts: capacity: 300–800 tablets p.m.; tablet diam.: 3/16"—5/8"; max. cell depth: 11/16"; floor space: 30" x 36", height: 60", net weight: 1025 lbs.

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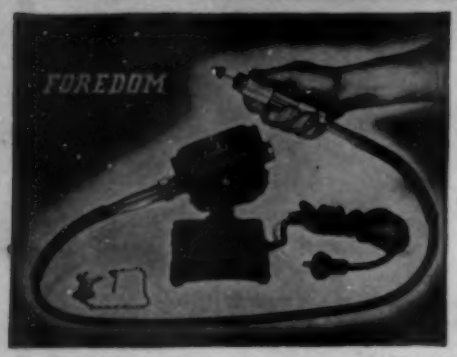
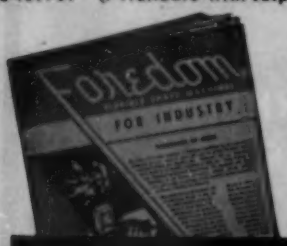
FOREDOM FLEXIBLE SHAFT MACHINES
Are As Versatile and Adaptable As Plastics Themselves



Model Illustrated is Foredom No. 340. Comes with either foot or hand-operated rheostat at $45.70. (Available with suspension-type motor. No. 240, at $43.20, including foot rheostat.) Other models as low as $23.50.



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Finger-tip control .... plus a wide variety of accessories ..... mean: precision workmanship, unlimited adaptability.

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Finishing and touching up plastic molded parts.

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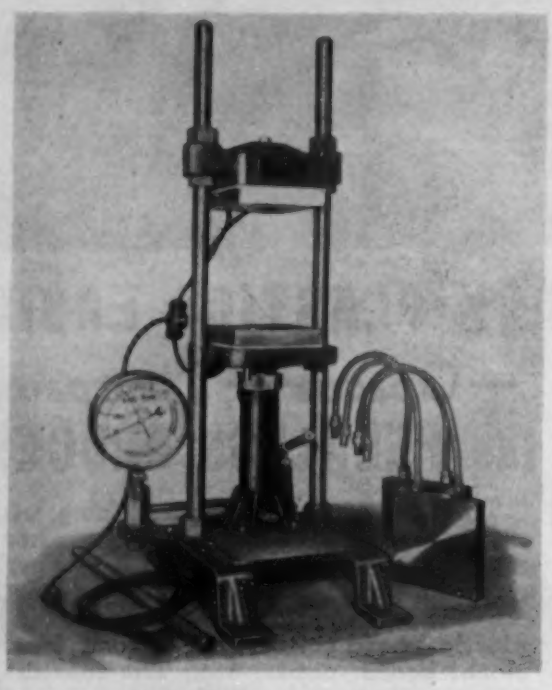

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Now used by many firms

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FOR SALE: 300 lbs. of gray cast phenolic rods 21" x ¾". 50c per lb. Write J. J. Halley, 31 Melbourne Ave., Detroit 2, Michigan.

WANTED TO BUY
PLASTIC INJECTION MOLDING MACHINERY
OR
SMALL PLASTIC INJECTION MOLDING PLANT
Send Details and Price
PARK TOOL & MACHINE CO.
17050 Hamilton Detroit, Michigan
UNiversity 3-7464

WANTED: Position in plastics industry. College graduate. ESMWT courses in plastics engineering, chemistry of plastics, plastics production and fabrication. 15 years' experience in industrial sales, Chicago area. Reply Box 966, Modern Plastics.

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FOR SALE: 6 Watson Stillman Hydraulic bench type arbor presses—6 Ton pressure at 2500 Lb. 1 sq. inch line pressure. Height over plate 14". Receives 20" diam. work. Reply Box 968, Modern Plastics.

MANUFACTURERS AGENT established for 8 years in the St. Louis area desires contact with manufacturers of Laminated and Extruded Plastic products as well as facilities to do custom work, also interested in Fibre account on straight commission basis. Have large following with industrial accounts in Missouri and Southern Illinois, as well as good contacts with Jobbing trade. Maintain Offices St. Louis. Reply Box 969, Modern Plastics.

WANTED—DOWELING MACHINE for sizing Celluloid or Casein Plastic Rods of ⅛-1½ inch diameter. Reply Box 972, Modern Plastics.

WE *WANT* INJECTION MOLDING PRESSES
WE'LL *EXCHANGE* EXTRUSION EQUIPMENT

Large Plastics Organization wishes to arrange an exchange deal to include equipment plus cash consideration. This is a fine opportunity to acquire extrusion presses and work out a profitable deal. Write fully to Box 971, Modern Plastics.

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Representative established long time Sao Paulo & Rio, wishes agencies of important manufacturers. First class references, guaranteed efficacy. Roger Levy, Caixa 45, Sao Paulo, Brazil.

FOREMAN

Small compression molding shop having all standard type presses. One having had previous experience with molding, cleaning and pill machines. Also mold setting.
Permanent position. At present working on war and essential orders only.
Certificate of availability necessary.
Please give details and arrangements will be made for interview at your convenience.
Box 973, Modern Plastics

WANTED—PLASTIC SUPERVISOR

We need a man who can start our plastics division, experienced in low pressure laminates and plasti-glass, should be thoroughly familiar with shop practice and tooling, capable of supervising production. Good proposition for right man. State your qualifications in letter addressed to: P. O. Box 128, Station K. Los Angeles 11, Calif.

ATTENTION MANUFACTURERS: Representative in Detroit, Mich., having Technical, Manufacturing and Sales background in the plastic industry, wishes to obtain sources for Materials, Supplies and Machinery for the Plastics Industry. Also lines of molded and fabricated Industrial stock parts. Territory Michigan, Indiana, Ohio. Warehouse provided if conditions warrant. Write Box 974, Modern Plastics.

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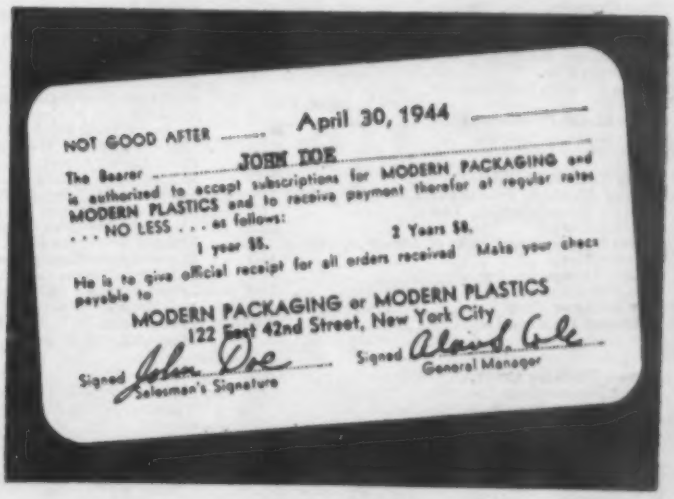
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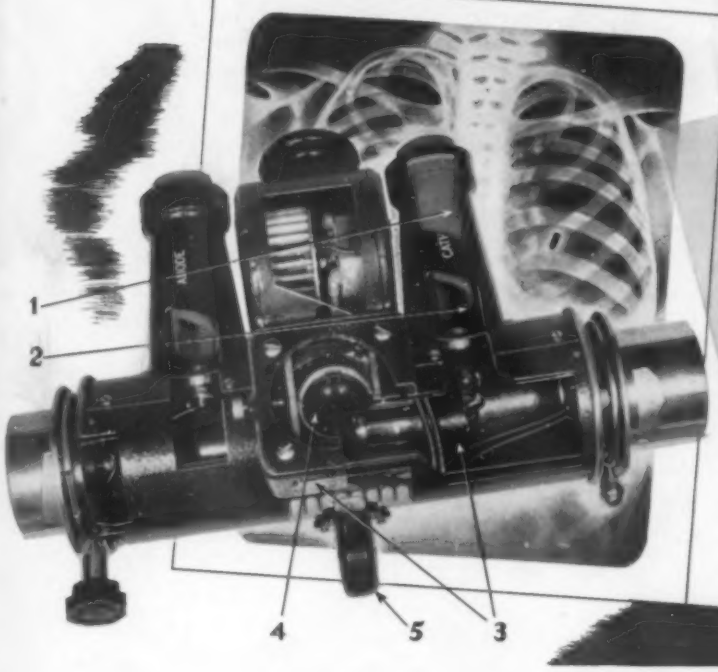

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Unit of Union Carbide and Carbon Corporation

UCC

Molding Plastics

*1421 CAST ROD

FORM AVAILABLE

Cast Rod — Maximum length—10"

PHYSICAL PROPERTIES

COLOR— pale yellow to water white

MACHINABILITY—good, similar to brass

SPECIFIC GRAVITY— 1.04–1.06

IMPACT (Dynstat)— .07–.08 ft. lbs.

FLEXURAL STRENGTH— (Dynstat) 7500–10,000 lbs./sq. in.

WATER ABSORPTION— less than 0.1% in 24 hrs.

DIELECTRIC CONSTANT— 2.4 to 2.5

POWER FACTOR— .0006–.0009

SOLVENT RESISTANCE—Generally insoluble in most solvents but swells in aromatic hydrocarbons.

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